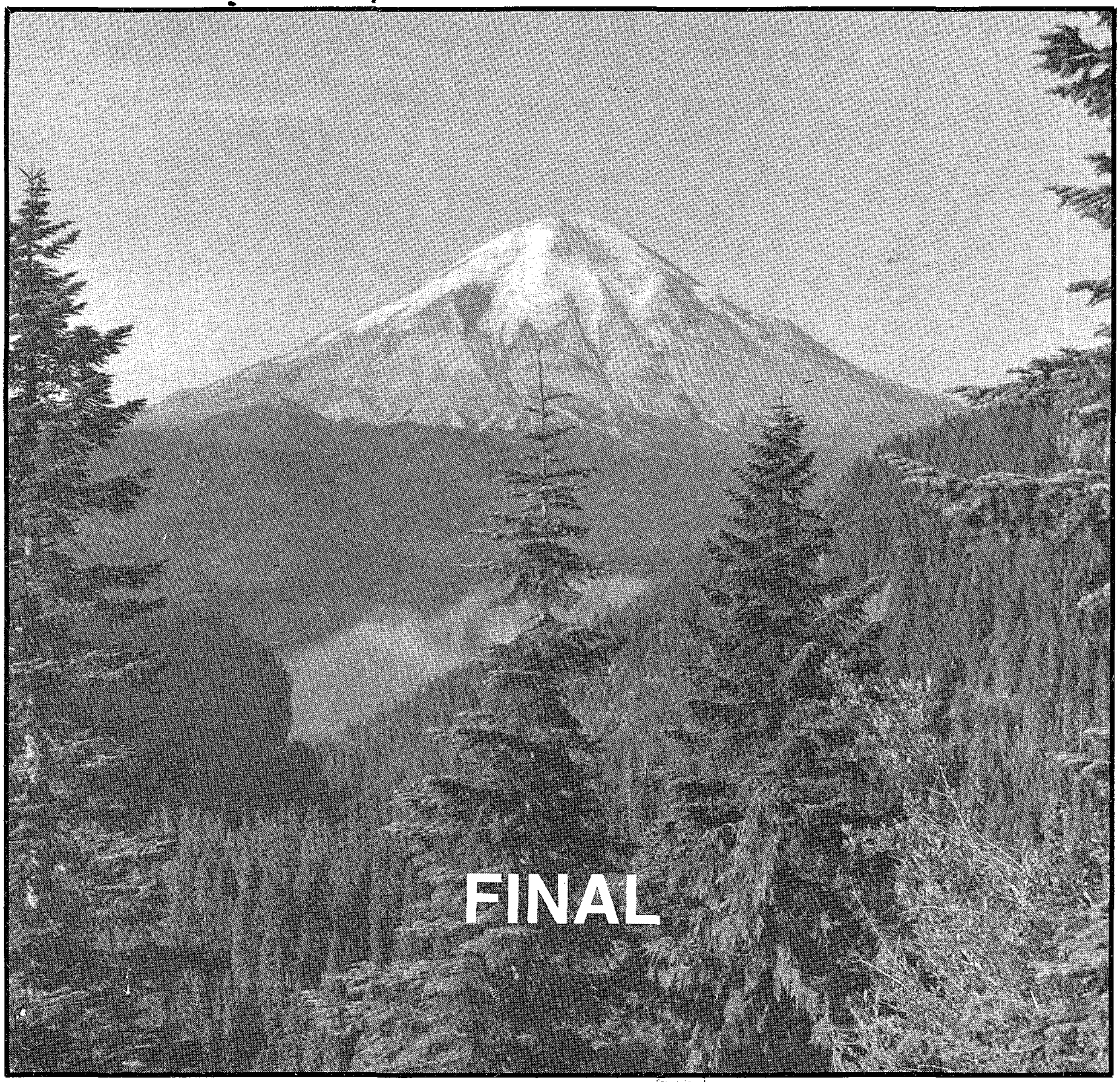
US Army Corps
of Engineers
Portland District

Volume 1
Main Report

Mount St. Helens, Washington Feasibility Report

& Environmental Impact Statement



Toutle, Cowlitz and Columbia Rivers

December 1984

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Photograph 1. Mount St. Helens, 18 May 1980
(U.S. Geological Survey)

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B	Comprehensive Plan - Sensitivity Analysis
C	Sedimentation
D	Engineering Analysis of Structural Management Strategies
E	Economic Evaluation

CHAPTER I - BACKGROUND

AUTHORITY

The eruption of Mount St. Helens, which began in the spring of 1980, resulted in the movement of sediment creating a threat of flooding and navigation disruption in southwestern Washington. President Reagan recognized that the Federal Government was spending millions of dollars for emergency action and would continue responding to any emergency which threatened life and property. Thus he requested, through a Memorandum to the Secretary of Defense, that the Corps of Engineers prepare alternative strategies for handling the projected movement of sediment. The strategies were to address the continuing problems of flood hazards and potential disruptions to navigation based upon engineering feasibility, economic merit and environmental sensitivity.

The report, "A Comprehensive Plan for Responding to the Long-term Threat Created by the Eruption of Mount St. Helens, Washington," was forwarded to the President in November 1983. The plan evaluated five alternative strategies for sediment control and analyzed six alternative outlets for stabilizing the level of Spirit Lake. In transmitting the Comprehensive Plan report, the Assistant Secretary of the Army recommended finding a permanent solution to the sediment control problem that could be forwarded for congressional authorization and funding. This report responds to that recommendation. Key elements of the Comprehensive Plan are summarized later in this document. Further refinement of the plan presented in this report will occur during the Continued Planning and Engineering (CP&E). In addition, analysis and design of other alternatives will continue.

STUDY AREA

The study area encompasses 1,200 square miles (sq. mi.) in southwest Washington, reaching north from the Columbia River to the headwaters of the Toutle River at Mount St. Helens. A vicinity map and a more detailed map of the study area are shown in figures I-1 and I-2, respectively.

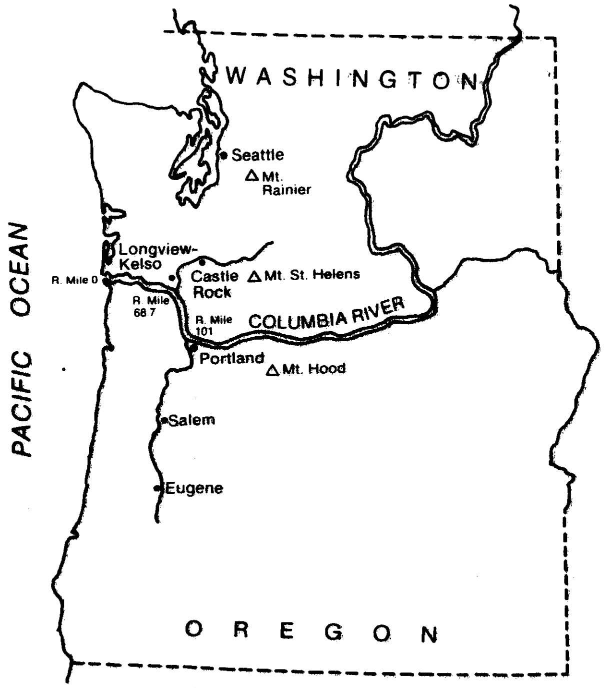


Figure I-1. Vicinity Map

The Columbia River flows east to west through a broad trough between the Cascade and Coast mountain ranges. It provides the navigation channel for vessels enroute from the Pacific Ocean to the deep-draft Ports of Vancouver, Washington, and Portland, Oregon. The reach affected by sediment accumulation lies between river miles (RM) 60 and 72. Lands along both shores, Oregon on the south, Washington on the north, consist of a narrow valley bottom adjacent to low hills. Several small, low-lying islands are located in the river through this reach.

The Cowlitz River and its principal tributary, the Toutle, are typical of rivers draining the west slopes of the Cascade Range. The terrain is mountainous and, except for clearcuts and areas devastated by the 1980 eruption, heavily forested.

The Cowlitz River drains an area of 2,840 sq. mi., including the Toutle River drainage area. Below its confluence with the Toutle, the lower 20 miles of the Cowlitz passes by the towns of Castle Rock, Lexington, Kelso, and Longview, Washington, before entering the Columbia River at RM 68.7.

The major tributaries of the Toutle River drain 432 sq. mi. The South Fork Toutle drains 129 sq. mi. and the North Fork Toutle, 303 sq. mi., including 131 sq. mi. from the Green River. In addition, the lower Toutle drains 80 sq. mi. for a total drainage area of 512 sq. mi. North and South Fork Toutle Rivers have their headwaters on the slopes of Mount St. Helens and carry runoff and sediment westward to the Cowlitz River. The North Fork Toutle River Basin includes three lakes, South Castle, Coldwater, and Spirit.

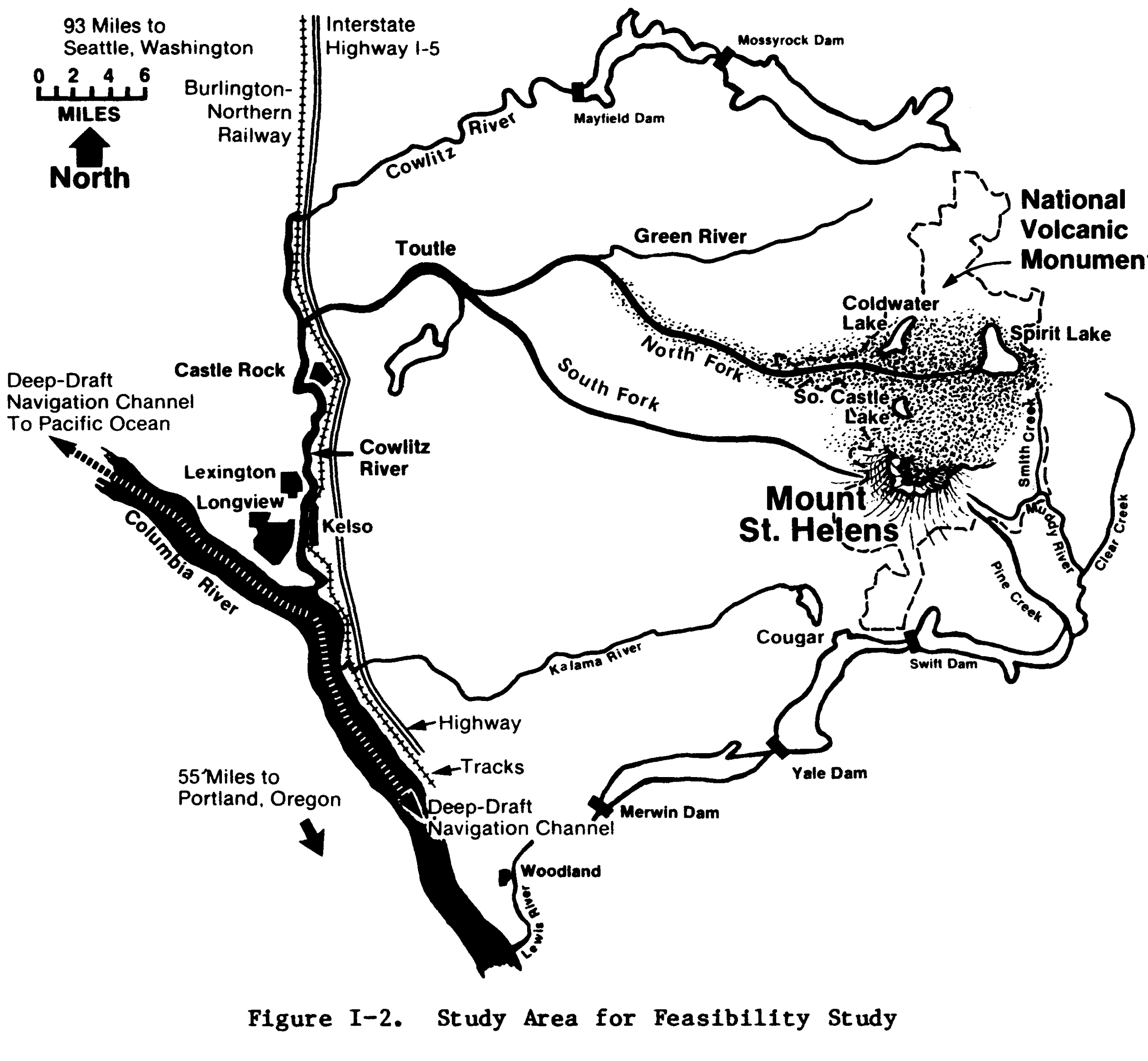


Figure I-2. Study Area for Feasibility Study

The area affected by potential flooding varies from bottom land along the Cowlitz to uplands at the base of the mountains of the Cascade Range. Industrial riverfront and urbanized property lie adjacent to both the Columbia River

and the downstream reaches of the Cowlitz River. Further up the Cowlitz, adjacent property contains less population, changing from urban to agricultural land use. The upper portion of the Toutle River Basin, except the volcanic and mudflow areas, is managed forestland.

STUDY SCOPE

This analysis addresses only the permanent solution to potential flooding on the Cowlitz River and disruption of navigation on the Columbia River caused by sediment buildup. A Decision Document (February 1984) dealt with the potential flooding due to a failure of the debris embankment at Spirit Lake. The solution to the Spirit Lake problem, a tunnel to North Fork Toutle River, currently is under construction. The present report also identifies the National Economic Development (NED) plan and its methodology, describes the preferred plan, includes an environmental impact statement, provides a possible cost-sharing formula, and recommends procedures for implementing the long-term solution to the sediment problem.

This report utilizes the formulation process developed in the Comprehensive Plan (see appendix A). It also contains the sensitivity analysis presented in the Plan (see appendix B) which shows the single retention structure as the least costly solution to the sediment problem. The revised sediment projections discussed in this report fall partly within and partly below the ranges of total sediment volume and annual sediment rates presented in Comprehensive Plan. This is due to our findings of reduced observed erosion. In the Comprehensive Plan, a total sediment range of 400 mcy to 2 bcy was discussed; in the Feasibility Report a range of 325 mcy to 975 is discussed. In the Comprehensive Plan, an annual range of 30 mcy to 70 mcy was discussed; in the Feasibility Report, various ranges were discussed and an initial annual rate of 28 mcy was chosen. A discussion of the impacts of the new sediment budget on the sensitivity analysis contained in the Comprehensive Plan follows in Chapter II.

In developing a permanent solution to the sediment problem, it became necessary to incorporate new information developed since completion of the Comprehensive Plan. These new data revised the projections on sediment movement and deposition. The major problems remain the increase in potential flooding to communities along the Cowlitz River, potential impacts due to interruption of the transportation corridor crossing the Toutle River, and potential disruption of navigation on the Columbia River.

This report also describes a base condition, which incorporates the interim Cowlitz dredging authorized by Public Law (PL) 98-63 (the Supplemental Appropriations Act of 1983), and analyzes its benefits and costs as a part of the economic study necessary to develop the NED plan. These changes will cover only additional data on sediment delivery, future studies of whether construction should occur in stages and comparative analysis of risks, benefits and costs; the overall plan is not expected to change during CP&E. This study has been conducted in compliance with the Water Resource Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies.

To further define the problems, investigation focused on updating Comprehensive Plan estimates for the amount and rate of sediment expected to erode and move through the system over a 50-year period. Study of the lower 20 miles of the Cowlitz River concentrated on the danger of flooding from continued sediment accumulation. In addition to damaging private, State, and industrial property, flooding could disrupt highway traffic on Interstate 5 (I-5) and rail traffic on the Burlington-Northern Railway line. Thus, the study of the lower Cowlitz assessed water elevations and economic loss from flooding and established impacts of proposed alternative measures to reduce those losses. Social and environmental effects of the alternative measures were also given careful consideration. The portion of the study dealing with the Columbia River, downstream from the mouth of the Cowlitz, focused on the effects of these alternative measures on navigation channel maintenance and on impacts to fish and wildlife for all affected areas.

STUDY LIMITATIONS

Overall, the study observed the limits defined in the Comprehensive Plan. First, it assumed that pre-eruption conditions were unlikely to be restored within the 50-year project life. Rather, alternatives were measured against the most probable future conditions.

Second, it assumed that another eruption of the magnitude and devastation of 18 May 1980 will not occur. This assumption was necessary, for a major eruption would necessitate a new study of the drastically changed conditions. Comprehensive studies of Mount St. Helens and other volcanic eruptions, both recent and in the geologic past, have established trends useful for predicting future eruptions and volcanic hazards. For example, based on the eruptive history of Mount St. Helens, Crandell and Mullineaux (1978) assessed Mount St. Helens as having a high probability of erupting within this century. Once a major volcanic sequence has been initiated, the sequence can last for several decades. Volcanic eruptions tend to be most frequent, volatile, and potentially dangerous during the initial phases of the volcanic sequences. The 1980 eruption diminished the chance of any future devastating debris avalanche into the North Fork Toutle River because a large portion of the mountain no longer exists. Thus, planning proceeded based on an assumption of no reoccurrence of a large event like that of 18 May 1980. However, because of the great uncertainties associated with future volcanic activity as well as potential mudflows, the study tests the preferred plan against the eventuality of such events to assure that the plan would not increase the hazards to downstream communities.

Traditional approaches used to forecast sediment movement had to be modified. Models used to simulate a river system's behavior over time would simply not accommodate studying the amount of sediment moving through the system or the changes in river hydraulics it produces. With these constraints on methodology and data, the study limited computer modeling of the river system to the lower 20 miles of the Cowlitz River and to the Columbia River at the mouth of the Cowlitz, where the effects of sediment deposition remain most critical.

Initially, the study assumed that the without-project condition would be defined as no-action. With passage of PL 98-63 on 30 July 1983, which authorized interim flood protection for developed portions of the Cowlitz River flood plain, a no-action condition became unrealistic.

This section summarizes the Comprehensive Plan which included a sensitivity analysis of the final alternative measures relative to different sediment rates and total quantities. It describes the emergency action accomplishments, the original problem statement, and alternative management strategies for dealing with the problems of sedimentation and Spirit Lake. This material provides the background for understanding the revised problem statement necessitated by the new sediment estimates and its effect on the sensitivity study presented in the Comprehensive Plan. Locations and sites associated with previous actions are indicated on figure I-3.

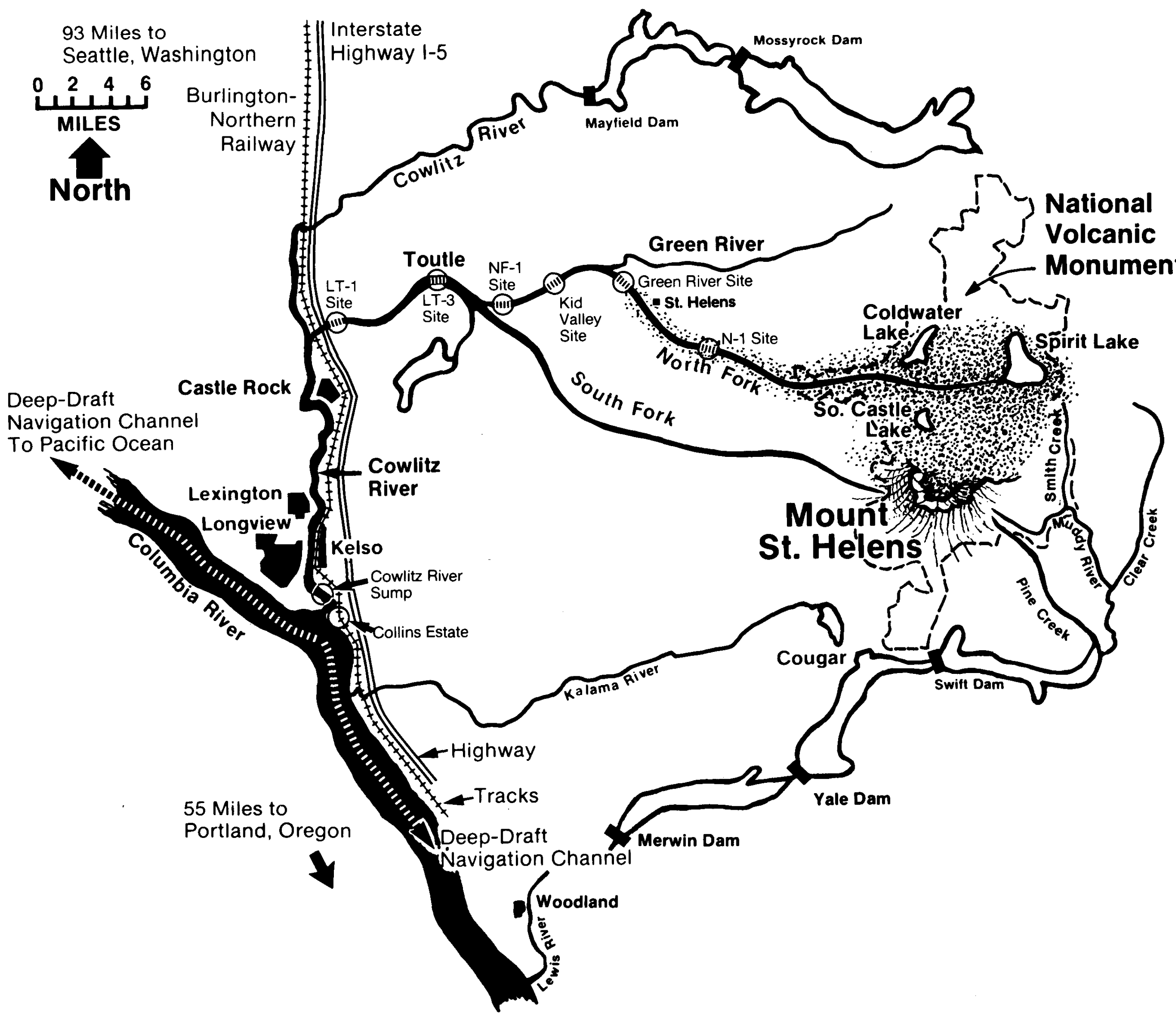


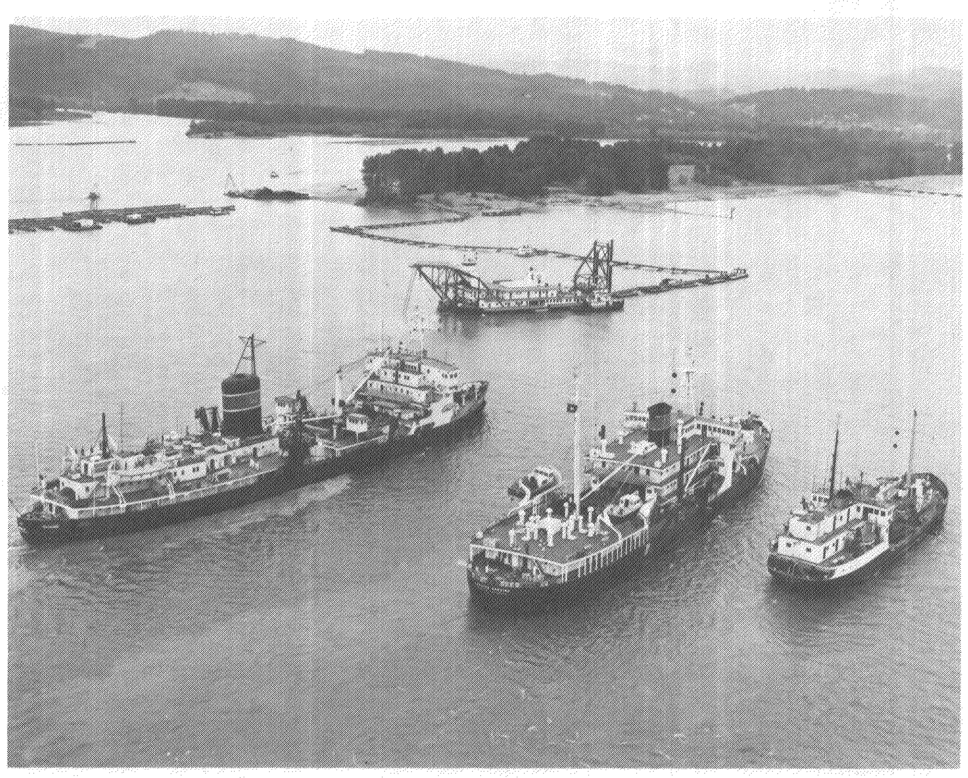
Figure I-3. Study Site Locations

Accomplishments Under Emergency Actions

Immediately after the 18 May 1980 eruption, the Corps of Engineers initiated emergency actions under PL 84-99 to reduce the flood potential at communities along the Cowlitz River and to restore the Columbia River navigation channel. From that time to the present, the Corps and other Federal, State, and local agencies have been intensively involved in emergency activities on the Toutle and Cowlitz Rivers to insure the safety of communities and the 50,000 people located along the Cowlitz. Through fiscal year 1983, Mount St. Helens related emergency activities by the Corps total $327 million, demonstrating the Federal Government's commitment to minimizing damage and property losses in those areas adversely affected by the extraordinary conditions created by the eruption. These emergency activities included improvements and temporary raises to levees, purchase of flood control storage from Tacoma City Light Company, construction of two debris retaining structures in the Toutle River Basin, excavation of sediment stabilization basins in the lower Toutle River, dredging the Columbia River construction of control outlets at Coldwater and South Castle Lakes, and emergency pumping at Spirit Lake.

Photograph 2. Temporary Levee Along Cowlitz River

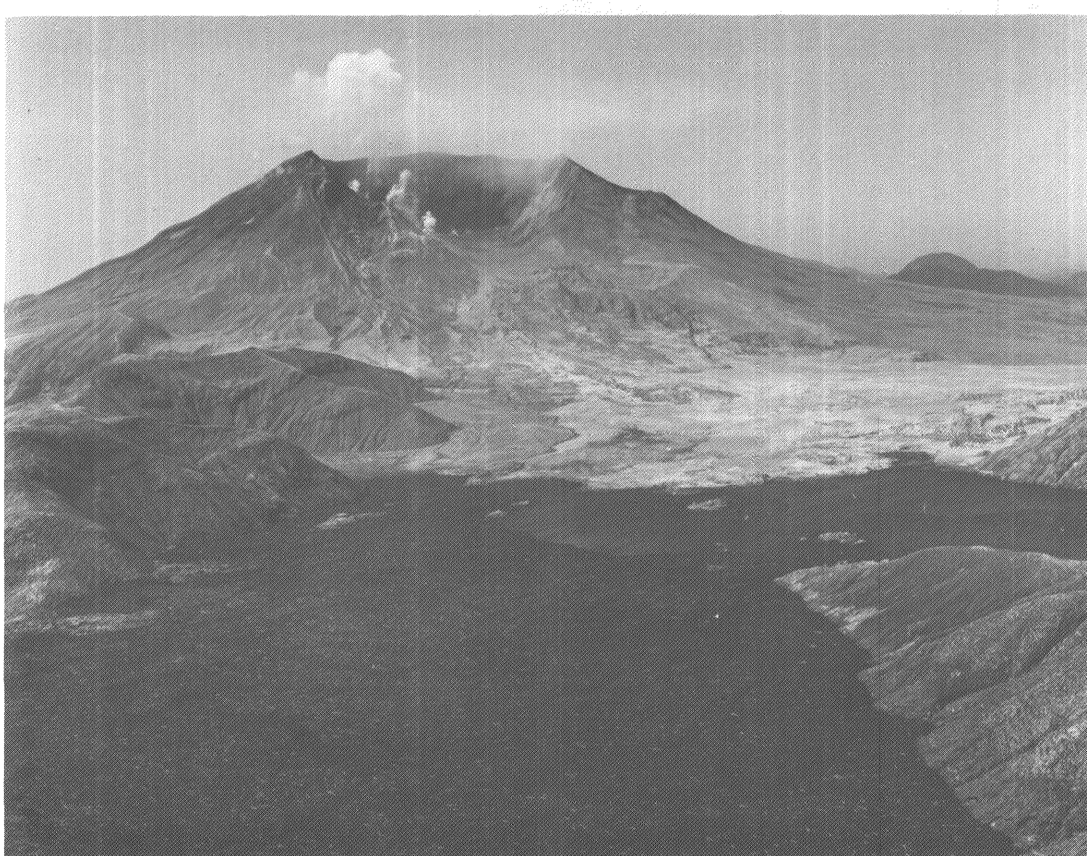
Photograph 3. Dredging at a Sediment Stabilization Basin



Photograph 4. Post-eruption Dredging in Columbia River Navigation Channel

Problem Statement (Comprehensive Plan)

The 18 May 1980 eruption of Mount St. Helens created a massive landslide which deposited more than 3 billion cubic yards (bcy) of material in the upper Toutle River Basin. This avalanche, covering 32 square miles up to 600 feet deep, is composed mainly of basalt and dacite material from the north side of Mount St. Helens, overlain by blast material and volcanic ash. During the eruption, the avalanche blocked some tributary streams, creating new lakes with unstable volcanic debris embankments in addition to blocking outlets to existing lakes.



Photograph 5. Mount St. Helens and Spirit Lake after 1980 Eruption

The Comprehensive Plan suggested that without preventive measures the following events would likely occur: (a) sedimentation in the Cowlitz River, causing flooding; (b) sedimentation in the Columbia River, interrupting navigation; (c) disruption of interstate highway and rail traffic; and (d) breakout of Spirit Lake, causing catastrophic flooding.

Flood Control and Navigation. Studies indicated that starting in 1980 an estimated 1 bcy of material would erode from the avalanche by the year 2030. Of this 1 bcy, approximately 50 million cubic yards (mcy) of sand, silt, and gravel would erode each year from 7 to 10 years, assuming average water year donations, with 30 mcy moving into the Cowlitz River system annually. Erosion of the avalanche was projected to decline annually after 1990. Without preventive action, this material passing through and depositing in the Toutle, Cowlitz, and Columbia Rivers would reduce the hydraulic, or flood-carrying capacity of the Cowlitz River channel. This in turn, would cause severe flood damages to the Cowlitz River communities and greatly increase annual dredging costs in the Columbia River. The lower Cowlitz channel would be filled with sediment by 1987; existing levees would no longer function effectively. The towns of Kelso, Longview, Lexington, and Castle Rock would be devastated by the resulting floods. The studies estimated damages by flooding to Castle Rock, Lexington, Kelso, and Longview would total $1.9 billion (1982 dollars) for the period 1983 to 1987, including damage to such major transportation arteries as I-5 and Burlington-Northern Railway bridges. Federally subsidized flood insurance coverage could total $900 million. While not anticipating a new eruption of the 1980 magnitude, studies indicated that minor volcanic activity, mudflows, a series of storms or rapid snowmelt would continue jeopardizing the lives and property of the people in the flood plain.

By the year 2030, the Cowlitz-Toutle system would deposit an estimated 319 mcy of sand in the Columbia River. That amounted to two times the 154 mcy needing excavation from the Columbia River during the same period assuming average years. Prior to the eruption, navigation maintenance costs averaged $4.4 million per year. If no action were taken to control the movement of Cowlitz-Toutle sediment, navigation maintenance costs could increase to about $25 million annually.

Spirit Lake. In addition to the damages caused by continued sediment flow from the debris avalanche, potentially disastrous floods would result if the embankment impounding Spirit Lake failed. Worst-case studies completed by the U.S. Geological Survey (USGS) indicated that a failure of this embankment would create a mudflow totally destroying development in the Cowlitz Valley. With an estimated peak flow of 2.6 million cubic feet per second (cfs), mudflow depths

could reach 60 feet in the upper reaches of the Cowlitz River at Castle Rock and 40 feet in the lower reaches at Longview-Kelso. Studies estimated peak flows entering the Columbia River at 1 million cfs.

Initially following the eruption, Spirit Lake had an elevation of approximately 3,462 feet with an impounded water volume of 278,000 acre-feet. Barge-mounted pumps operated from 5 November 1982 to 31 July 1983, pumping water from Spirit Lake to the North Fork Toutle River. Pumping resumed on 22 September 1983 and continued through July 1984. Pumping again resumed on 2 October 1984. Without pumping or failure of the debris embankment, the blockage would overtop in late fall or early winter 1985-86. Estimated damages could reach $2.5 billion.

Alternative Management Strategies (Comprehensive Plan)

The Comprehensive Plan used two separate, but related, planning processes to determine alternative management strategies for addressing the problems of sedimentation downstream of Spirit Lake and maintenance of a safe water level at Spirit Lake.

Sedimentation. The urgent need to protect communities along the Cowlitz River and the inherent uncertainties associated with sediment predictions required a flexible and rapidly implementable solution. Such a solution would also resolve the deep-draft navigation channel problems in the Columbia River caused by the sediment flow. Experience in emergency actions since the eruption contributed to the selection and analysis of potential solutions. The Comprehensive Plan analyzed 13 measures in formulating a plan to prevent flood damages on the Cowlitz River and to reduce maintenance dredging costs on the Columbia River.

Criteria used in screening the various alternatives focused on the effectiveness of each in accomplishing the following major objectives: reducing flood damages; reducing navigation maintenance costs; minimizing impacts on fish and wildlife; and providing flexibility to allow for uncertainties in sediment movement prediction. The preliminary screening produced five alternative management strategies which warranted more detailed study. The following

paragraphs briefly describe these strategies, with appendix A containing a more thorough discussion of them.

Limited Permanent Evacuation. As the Cowlitz River filled with sediment, threatened areas upstream of Kelso and Longview, including the communities of Castle Rock and Lexington, would be evacuated and allowed to flood. Levees near Longview and Kelso would be raised, as would major highway and railway bridges. Dredging requirements in the Columbia River to maintain deep-draft navigation would increase sixfold in cost to $25 million annually.

Sediment Stabilization Basins. Basins (sumps excavated in the riverbed) would be located at three sites in the Toutle and North Fork Toutle Rivers; annual dredging and off-site disposal would be required, both at the basins and downstream in the Columbia River.

Multiple Retention Structures with Dredging. Four earth- and rock-fill structures would be constructed concurrently across the main stem and North Fork Toutle Rivers. The retention structures would be about 40 feet high, and would trap most sediment except during high flows when material would pass over the structures. Dredging and extensive off-site disposal would be required, both at the structures and downstream in the Columbia River.

Multiple Retention Structures without Dredging. Structures 160 to 190 feet high would be located at three sites on the Toutle River. The first structure would be built downstream and the others added upstream as needed; the sediment trapped would not be removed. Dredging on the Cowlitz and Columbia would still be necessary to cope with material already in the system below the structures.

Single Retention Structure. A single, roller-compacted concrete, gravity dam 250 feet high would be constructed across the Toutle River at one of three sites. The structure would prevent sediment from passing in all but extreme flood conditions. It would rise in stages to the maximum of 250 feet; trapped sediment would not be removed. Some additional measures such as dredging would be required to keep material already in the river system below the structure from reaching the Cowlitz and Columbia Rivers.

Total Costs of Alternative Management Strategies

The total costs of the alternatives and the net present value of those costs which would have accrued over the life of the project are shown in the following table.

Table I-1
Total Costs of Alternative Management Strategies
($ millions)

Management Strategies	Total Cost	Present Value of Total Costs	Present Value of Average Annual Costs	Benefit-to-Cost Ratio[1]
1. Limited Permanent Evacuation	$1,048.1	$612.7	$49.4	2.68
2. Sediment Stabilization Basins	751.0	398.1	32.1	4.12
3. Multiple Retention Structures with Dredging	1,153.3	685.6	55.2	2.40
4. Multiple Retention Structures without Dredging	536.6	340.8	27.5	4.81
5. Single Retention Structure[2]	341.7	243.1	19.6	6.75

1. All plans provide cumulative average benefits of $132,300,000.
2. Used Green River site costs.

Sensitivity Analysis of Alternate Management Strategies

The Comprehensive Plan developed a sensitivity analysis which included changes in both total sediment volume eroded and initial annual sediment delivery for all five management strategies. The sensitivity analysis indicated the impact of variations from the anticipated 1 bcy total sediment erosion and initial annual erosion of 50 mcy. Total erosion varied from as little as 400 mcy to a high of 2 bcy. Initial annual erosion ranged from 30 mcy to 70 mcy. The analysis measured in dollars the sensitivity of the management strategies to these variations (see appendix B).

Each of the five management strategies possessed flexibility to respond to changes in total sediment yield. Strategies 1, 2, and 3, which involved the dredging and disposal of sediment, proved the most sensitive and varied the most in cost. Strategies 4 and 5 were more stable because those structural solutions did not require sediment handling. Ranges in cost for the five strategies and the three total sediment yields are shown in table I-2. A drastic reduction in the total sediment yield, from 1 bcy to 400 mcy would result in strategy 2 being less expensive than strategy 5.

Table I-2
Alternative Management Strategies Cost Comparison
Total Sediment Yield

Management Strategy	Total Sediment Yield (Cost $000)		
	400 mcy	1 bcy	2 bcy
1	$527	$1,048	$2,500+
2	218	751	2,000+
3	346	1,153	2,500+
4	311	537	670
5	275	342	442

The management strategies were relatively insensitive to changes in annual sediment delivery. Within the range of 30 mcy to 70 mcy annual erosion, the five strategies did not change in their relative ranking. Strategy 5 proved far less expensive than any other strategy, as shown in table I-3.

Table I-3
Alternative Management Strategies Cost Comparison
Annual Sediment Yield

Management Strategy	Annual Sediment Deliveries (Cost $000)		
	30 mcy	50 mcy	70 mcy
1	$1,048	$1,048	$1,048
2	706	751	898
3	1,166	1,153	1,151
4	490	537	557
5	331	342	367

In summary, strategy 5 (single retention structure) was the most cost effective of the strategies, except in the extreme reduction of total sediment erosion. In that situation, strategy 2 (sediment retention basins) was somewhat lower in cost.

The sensitivity analysis results indicate that costs of management strategies are relatively immune to variations in initial rates of erosion between 30 and 70 mcy/year. Additionally, the analysis shows that costs of strategies concentrating on dredging for sediment removal are sensitive to total sediment volumes, while costs of strategies focusing on structural blockage of sediments are relatively insensitive to total sediment volumes.

These sensitivities result from the fact that the Cowlitz and Toutle basins are narrow valleys with large disposal sites at a premium. Once the inexpensive disposal sites are used up, as now occurring, dredging costs rise greatly with the additional hauling needed to reach more distant sites. The efficiency of the structural strategies not needing large dredging efforts varies less over a wide range of total sediment delivery.

Spirit Lake

A Decision Document, prepared in February 1984, evaluated the six alternatives to solve the Spirit Lake problem and included concerns from agency and public involvement.

The elevation of 3,440 feet NGVD was verified as the best level to lower Spirit Lake, considering debris embankment stability and visual esthetics. The Decision Document eliminated open channel and permanent pumping alternatives because of potential risk and safety problems and lack of agency and public support. Although tunnel alinement B_1 was rated high in safety, constructability and public support, the interbasin transfer of water and potential water quality impacts made this alternative unacceptable to the Governor of Washington and various agencies. The remaining three alternatives - buried conduit, and tunnel alinements F and G - were then compared and alinement F recommended. Tunnel alinement F is now under construction with drawdown scheduled to begin about 1 April 1985.

CHAPTER II - UPDATED PLANNING CONSIDERATIONS

GENERAL

Following completion of the Comprehensive Plan, the U.S. Geological Survey (USGS) and other sources supplied additional data which necessitated a reevaluation of the sediment analysis. The Comprehensive Plan problem statement discussed in the previous section was the direct consequence of the projected sediment budget. Major revisions to the sediment budget necessitated reanalysis of the problem statement. This section presents the changes to the sediment budget, revises the problem statement based on those revisions, compares the changes with the Comprehensive Plan sediment budget, describes a base condition from which all alternatives are measured, and estimates impacts on the sensitivities given in the Comprehensive Plan.

The problem statement contained in the Comprehensive Plan is based on a no-action condition which is not considered realistic. This section defines a base condition which reflects the Federal Government's commitment to providing protection for communities on the Cowlitz River, including activities already undertaken as a result of PL 98-63. However, actions associated with the base condition must themselves be justified against the no-action condition. Therefore, the following discussion of the no-action condition is to serve only as an economic comparison for the base condition actions.

The uncertainties associated with the sediment budget developed for this report, as well as that for the Comprehensive Plan, have been dealt with by performing sensitivity analyses on proposed management alternatives. Monitoring and refinement will continue during the design phase to incorporate the most up-to-date sediment information available. The sediment budget used in this report is based on observed erosion and sediment movement from the debris avalanche in the Toutle-Cowlitz system during the past four years. Data available included Cowlitz/Toutle suspended sediment data through September 30, 1983, Cowlitz/Toutle River cross sections through April 1984, U.S.G.S. debris avalanche cross sections through early 1984 and debris avalanche backhoe soil samples from May 1984. Projections for future erosion and sedimentation are based on these observations and the average hydrology of the past 50 years. The largest storm during the past 4 years had approximately a 10-year occurrence frequency. While there has been no extreme post-eruption storm event, Spirit Lake has experienced several intense rain storms. Monthly rainfall in November 1983 was 229% of normal including an intense 3.33 inches on one day. It is expected that large quantities of material will erode with

extreme events (100-year and above) or as a result of volcanic or hydrologic events. Although no historical basis exists for raising the current sediment budget, sediment ranges on the high side have been considered in evaluating alternatives to cope with future special events.

The monitoring and refinement is essential since consultants and some scientists in the field, who have had the opportunity to briefly review the sediment analysis, are concerned that estimates presented may be low both in total volume and rate of delivery because they are based on average hydrology. These concerns reflect the uncertainties of sediment forecast for volcanic and hydrologic events and the fact that infrequent storms or mudflows could produce sediment deliveries in excess of the forecasted amounts.

Photograph 6. The Debris Avalanche with N-1 Retention Structure at the Toe (Jan Fardell)

REEVALUATION OF SEDIMENT BUDGET

Background

The sediment budget presented in the Comprehensive Plan contained the best available sediment transport measurements and cross-sections of the avalanche. Sediment transport measurements supplied the data to develop an estimate of sediment yields to the Cowlitz River. The cross-sections were used to develop the eventual equilibrium profile and channel geometry in the avalanche and to estimate total and annual sediment yields. Scour, deposition and yield patterns in the Toutle/Cowlitz River system were then computed from the debris avalanche to the Columbia River.

The principal conclusions of the Comprehensive Plan analysis included:

a. The sediment erosion from the avalanche would average 50 mcy per year for the initial 7 to 10 years, and would total 1 bcy during the 50-year project life.

b. The Toutle River system was a depositional area for sediments.

c. For no-action conditions, maximum accumulative deposition of 50 mcy in Cowlitz River would be reached in 1987 and 240 mcy would have to be dredged from Columbia River between 1981-2012 to maintain the navigation channel.

During the preparation of that sediment budget, the study team recognized that the data were limited, that some assumptions would have to be checked, and that the sediment budget needed review whenever additional data became available.

In October 1983 the Portland District began receiving updated data. The USGS provided tabulation of the total sediment transport for water years (WY) 1981 and 1982 at Kid Valley on the North Fork Toutle River, at Tower Road on the main stem Toutle River, and at Castle Rock on Cowlitz River. Total sediment data from these stations for WY 1983 arrived in February and March 1984.

Updated USGS cross sections of the avalanche and the Toutle River system taken repeatedly from 1980 to 1983, became available in late 1983 and early 1984.

Results from an Oregon State University (OSU) study of the debris avalanche, including cross sections, sediment yields, geomorphic processes, and drainage and channel development, were periodically received from late 1983 to early 1984. OSU's final report was received in June 1984.

The compilation, comparison, analysis and interpretive results of the recently received data are discussed and documented in appendix C, Sedimentation Study for Feasibility Report.

Objectives

The objective of a sediment analysis is to predict changes to water surface profiles resulting from future sediment deposition in the Cowlitz River and to predict future sediment deposition which could interrupt navigation in the Columbia River. Estimates of sediment deposition provide a basis for planning sediment control measures. The sediment budget focuses on the composition and rate of sediment movement through the Toutle/Cowlitz/Columbia River system.

FORECAST OF FUTURE SEDIMENT MOVEMENT

To develop a long-term sediment/flood control and navigation plan for the Toutle/Cowlitz/Columbia system requires predicting future sediment yields and identifying the sources of those sediments. Critical elements contributing to a sediment budget are identified below and addressed in more detail in appendix C.

Elements of Forecast

Debris Avalanche Deposits. The forecast estimates total volcanic deposits, their composition, volume, slope stability, and distribution.

Avalanche Erosion Processes and Trends. The forecast predicts drainage network development on the avalanche, stream channel incision and widening, effects of a rising water table, and processes contributing to sediment loading of streams.

Toutle River. The forecast analyzes scour and depositional patterns, potential for bank erosion, and sediment movement through North Fork and main stem Toutle River.

Cowlitz River. The forecast studies the scour and depositional patterns in the Cowlitz River that occurred during WY 1982 and 1983. That analysis included the effects of dredging, changes in bed material, and grain sizes transported and/or deposited; an estimate of future sediment movements (as determined by HEC-6 modeling with input from hydrographic survey), sediment sampling and hydrologic records; and forecasting future flood elevations from the estimate of sediment depositions over time and place.

Columbia River. The forecast uses HEC-6 modeling to determine the depositional pattern in the Columbia River navigation channel and provides an estimate of future deposition.

The following summary discusses a forecast of erosion, transport, and deposition for each of the streams mentioned above. These forecasts are based on the data and analysis presented in appendix C and represent the best current estimates. The actual volumes of sediment eroded, transported, and deposited in any single year will range above or below those shown, but the long-term averages should reflect forecasted trends. As new information becomes available and knowledge of the complex processes occurring in the system grows, these estimates will improve.

Debris Avalanche

Sediment yields from the debris avalanche are expected to remain high throughout the 50-year project life. Ongoing changes occurring in the avalanche will gradually reduce the rate of erosion, but based on yields from other watersheds presented by Brown and Ritter (1971), the Toutle River Basin is expected to remain the most rapidly eroding watershed of its size in the United States.

Base Level Sediment Yields. Base level sediment yields are those expected from the debris avalanche as a result of normal hydrologic sediment erosion processes. Estimated base yields are determined by the initial yield and expected changes on the debris avalanche.

Forecasted Sediment Yields. Under conditions existing during the past three years, and projected to continue for several more, a number of non-base level events have happened. The most significant of these events include mudflows, lake breakouts, and major changes in channel alinement. Because the base level yields did not contain any allowance for these events, these levels are too low for use in defining the problem statement.

A forecasted sediment yield curve was prepared by incorporating the base curve and the non-hydrologic (mudflow) sediment producing events. The initial yield for this curve is 28 mcy per year (figure II-1). This curve allows for the occurrence of mudflows, channel re-alinements, and above normal peak storm discharges. These are discussed in more detail in appendix C.

Yields from Infrequent Events. The sediment entering the Toutle-Cowlitz River system is delivered episodically, for the most part during winter storms. Just how much sediment is transported is dependent on the intensity, duration, and timing of these storms. The timing of these yields cannot be determined precisely because of the infrequent nature of events such as mudflows or storms.

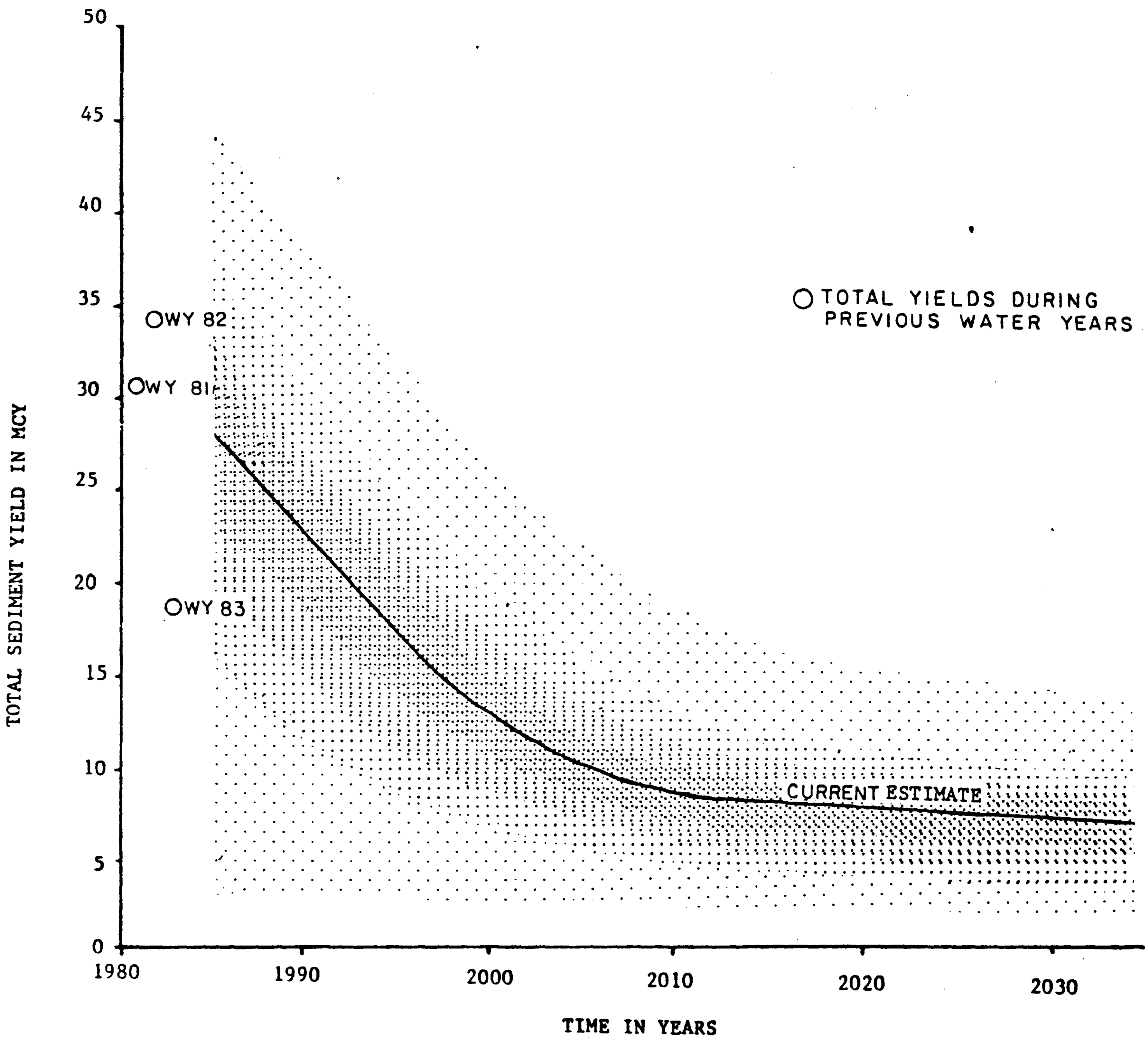


Figure II-1. Forecasted sediment yield from the debris avalanche.

Sediment transport varies as an exponential factor of water discharges. Thus, high streamflows during major storms carry many times the amount of sediment transported by smaller flows. In the Pacific Northwest, these storms often occur in series: two storms can occur within two or three weeks, each transporting a large quantity of sediment. In such cases the lower Cowlitz River would not be able to transport all the sediment delivered by the first storm through the system before the second storm yielded an additional load of sediment. A series of storms in 1982, for example, delivered an estimated 12 mcy of sediment to the lower Cowlitz within 4 weeks; the total yield to the Cowlitz for that year was an estimated 34 mcy.

Another unpredictable variable is the occurrence of mudflows. Mudflows--flow carrying as much as 60 to 80 percent solid material--are potentially major contributors to sedimentation problems in the Toutle/Cowlitz/Columbia River system. In just a few hours they can deposit millions of cubic yards of sediment in river channels. These mudflows can be generated by heavy rainfall on the debris avalanche. When groundwater levels are high, saturated channel banks slump into the flow. In addition, mudflows can also be triggered by minor volcanic eruptions. On 19 March 1982, a relatively small eruption occurred while a snowpack existed in the crater. Part of the blast was directed against the crater wall, rapidly melting ice and snow. The resulting mudflow, moving about 30 feet per second in the headwaters region of the North Fork Toutle, eroded 14 mcy of sediment from the debris avalanche. All but 4 mcy of this mudflow redeposited above debris retention structure (DRS) N-1. Current estimates indicate that Mount St. Helens will continue erupting, though these eruptions will not be as dramatic as the 18 May 1980 event. However, minor events like the 19 March 1982 eruption are expected to occur frequently.

A design mudflow, which is used in later risks analysis, is developed and described in appendix D. The design mudflow is considered an infrequent event, with an approximate recurrence interval of 100 to 200 years, and is estimated to contain 75 mcy of sediment.

Projected Erosion

North Fork and Main Stem Toutle Rivers. Approximately 20 mcy of the 92 mcy yards of sediment delivered to the Cowlitz River in water years 1981-83 eroded downstream of the debris avalanche. Study results showed the existence of a large source of sediment but also indicated that almost all of the erosion on the Toutle River occurred within the 1980 mudflow deposits. An older lahar or mudflow, the Pine Creek lahar that underlies and bounds the 1980 mudflow, was coarser in size and less susceptible to erosion and transport. The study also estimated the material volume of the 1980 mudflow deposit at 20 mcy in the channel and floodplain of the Toutle and North Fork Toutle River. The projected rate of erosion based upon observed sediment transport, channel hydraulics, and theoretical development of landscapes, suggested a sediment yield beginning at 5 mcy/year and declining to less than 0.5 mcy/year in 10 years.

Cowlitz River. The volume of fine sand and coarser material delivered to the Toutle River governs sediment deposition in the Cowlitz River. However, based on the results of sediment transport modeling for the no-action condition, the initial volume of deposition is assumed equal to 35 percent of all sand delivered by the Toutle River. The best estimate of avalanche yields combined with Toutle River erosion gives the projected sand yield to the Cowlitz (figure II-2). This results in an estimate of a maximum 78 mcy of deposition in the Cowlitz River, if no aciton is taken to reduce sediment accumulaton.

Columbia River. Winter sand discharge from the Cowlitz River could deposit in the Columbia River and interfere with shipping in the vicinity of the Cowlitz/Columbia confluence for the entire 50-year project life. Figure II-3 shows the forecast deposition based on projected Cowlitz River sand discharges. Assuming near-average runoff, the problem will be most severe during the first 7 to 10 years, when predicted erosion rates on the avalanche and Toutle River are highest. Deposition in the Columbia River should only be a problem during the winter, when Columbia River flows are low and storms in the Toutle River Basin produce large volumes of sediment.

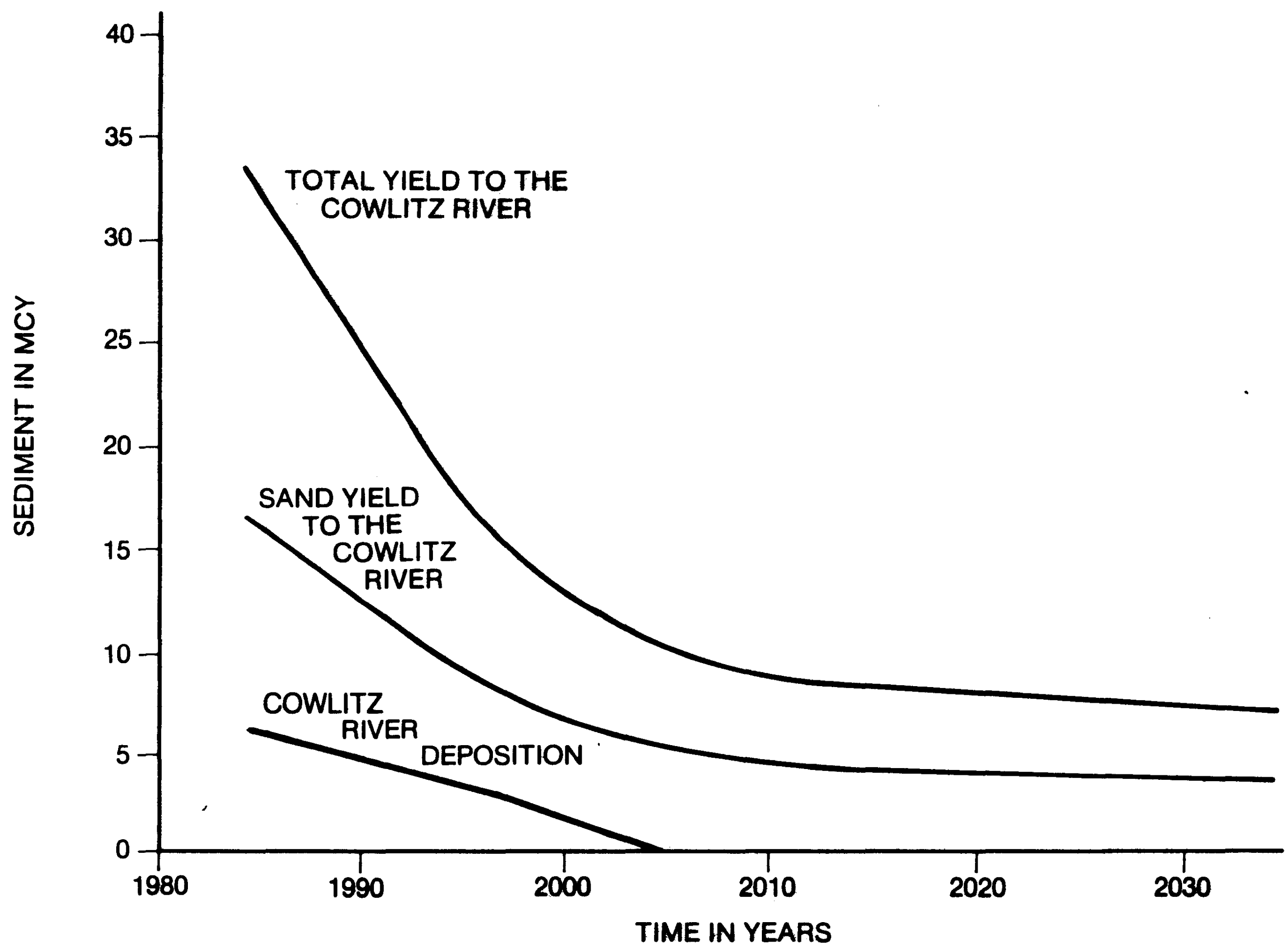


Figure II-2. Cowlitz River annual yields.

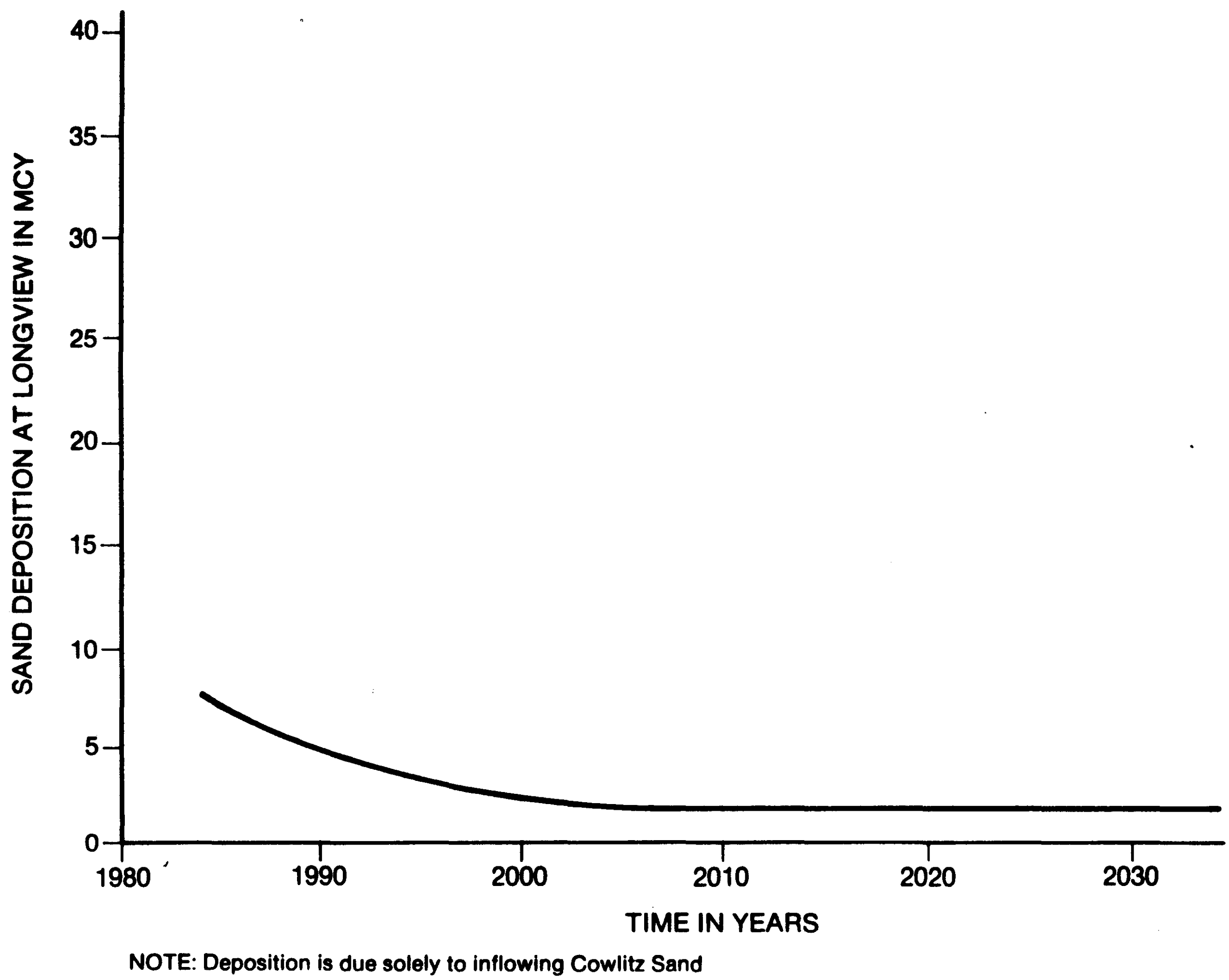


Figure II-3. Forcasted Columbia River Sand Deposition at Longview
Under No-Action.

COMPARISON OF NEW SEDIMENT ANALYSIS WITH COMPREHENSIVE PLAN SEDIMENT ANALYSIS

The Comprehensive Plan estimated 1 bcy of sediment erosion from the debris avalanche during the 50-year project life. This assumed an initial rate of erosion equal to the then-estimated WY 1981 and 1982 average of 50 mcy/year. The revised sediment budget presented in this report predicts approximately 750 mcy of total erosion beginning in 1980, with an initial erosion rate of 28 mcy/year. The Comprehensive Plan bases total volume of erosion on an estimated equilibrium stream profile and channel widths. In this report, the total volume of erosion is founded on a geomorphic evaluation of changes likely to occur in the nine reaches of the debris avalanche and on the potential for unusual events occurring that could disrupt the system with higher than normal sediment yields. Much of the difference between the two estimates in both total volume and initial rate comes from greatly revised projections in gravel yields. The Comprehensive Plan estimated gravel yields totaling nearly 400 mcy during 50 years beginning at an initial rate of 20 mcy/year. The revised budget in this report projects a total of approximately 50 mcy of gravel yield, with rates beginning at 1 mcy/year. Total estimated sand yield, which is the primary cause of increased water surface elevations, remains the same as in the Comprehensive Plan.

The rate of decay and levels to which yields will decline also differ between the Comprehensive Plan and the best estimate presented in this report. The difference is shown on figure II-4. The higher yields currently projected for the end of the 50-year period result primarily from sediment sources immediately downslope of Mount St. Helens.

Another difference between the Comprehensive Plan and this report is the behavior of the North Fork and main stem Toutle Rivers. In the Comprehensive Plan, they are classified as areas of sediment deposition but updated studies indicate they really may be areas of sediment erosion. That change in classification accounts for the earlier decline in sand yields to the Cowlitz River, shown in the Comprehensive Plan, as material would not be stored for later erosion (figure II-5).

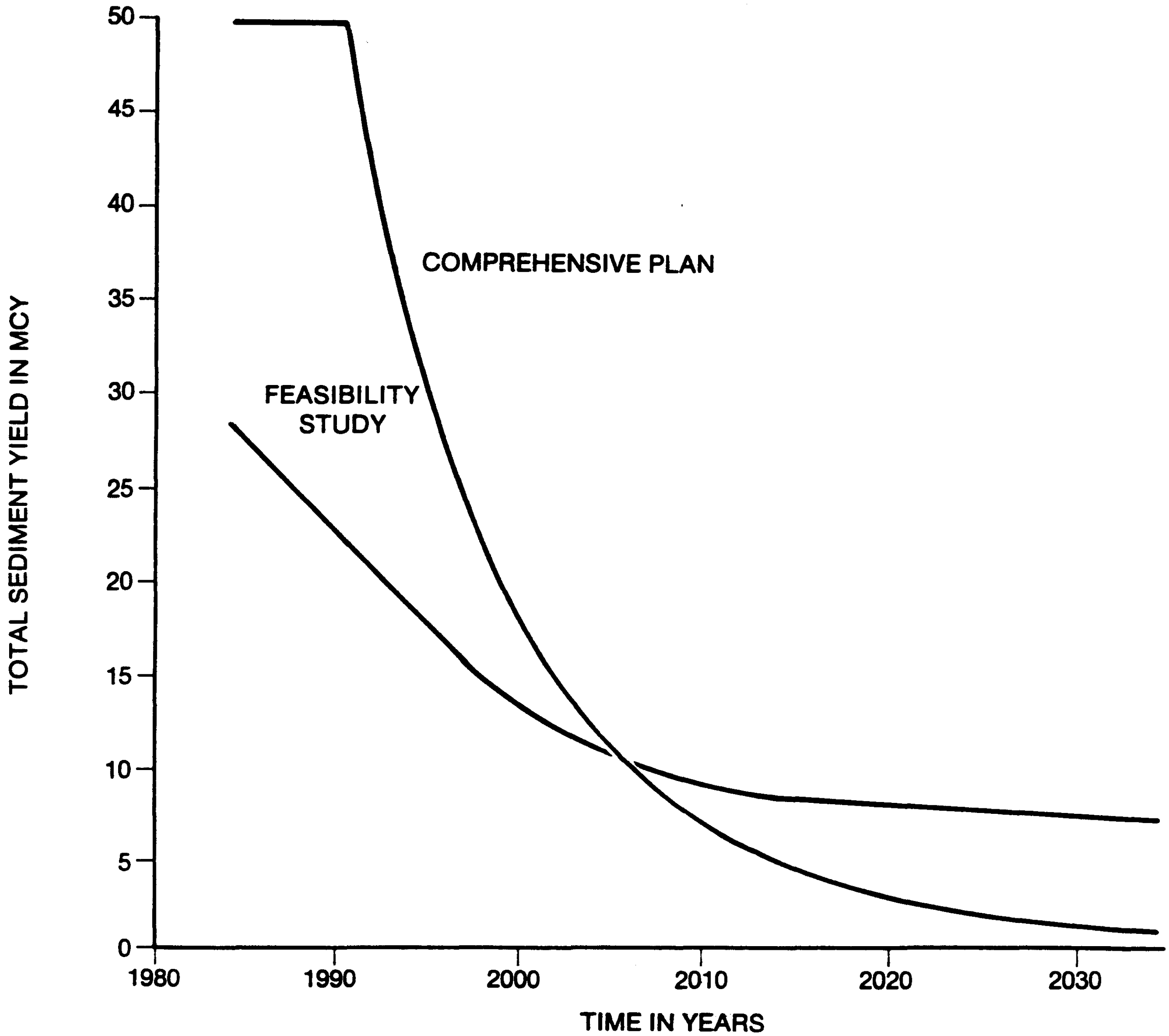


Figure II-4. Total avalanche sediment yields, Comprehensive Plan vs. Feasibility Report.

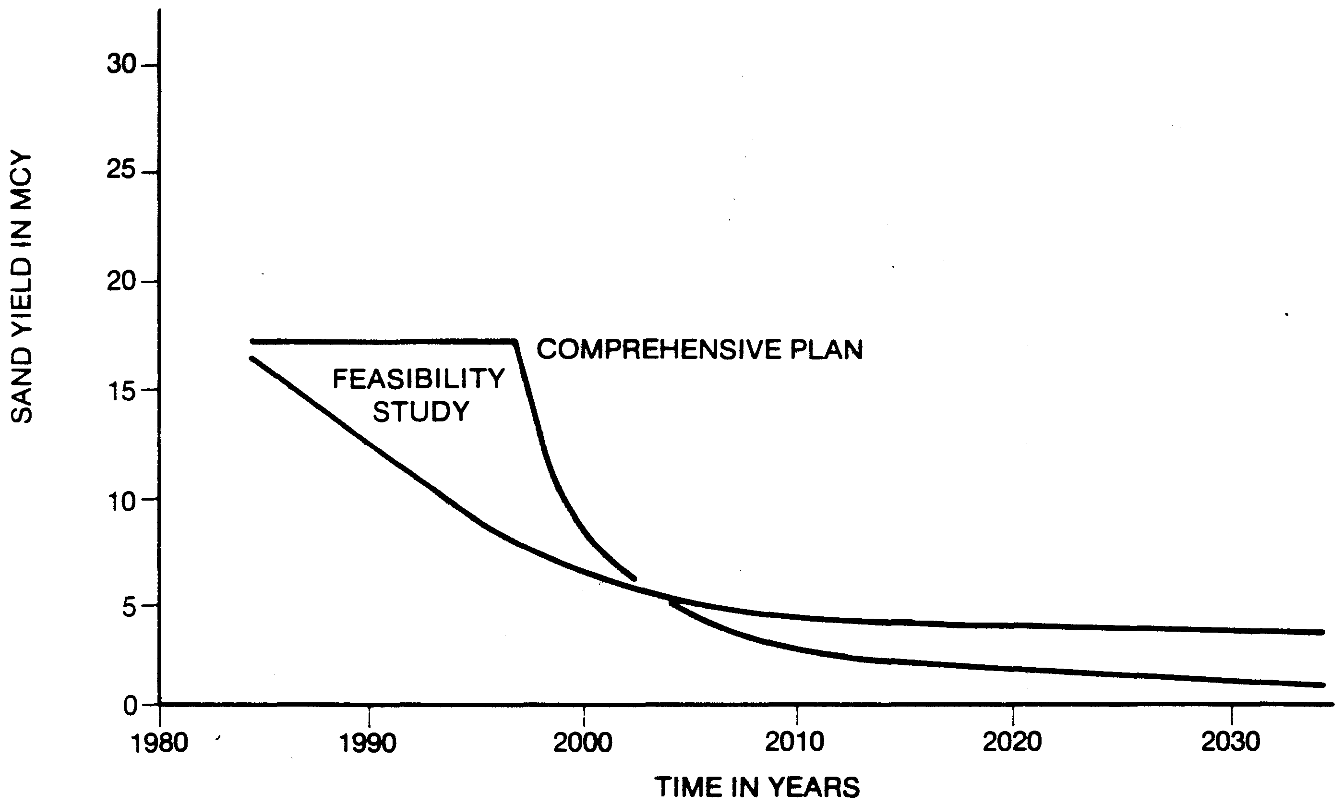


Figure II-5. Toutle River Sand Yield, Comprehensive Plan vs. Feasibility Report.

The projected Columbia River dredging requirements for the no-action condition during the 50-year project life was 242 mcy in the Comprehensive Plan, compared to the 145 mcy in this report. The three main reasons for this difference are:

- The change in debris avalanche yield magnitudes and decay rates.

- The assumption in this report that 70 percent of the annual Cowlitz River sand discharge occurs in the winter, as opposed to 100 percent shown in the Comprehensive Plan. Only the sand fraction is considered a potential depositional problem.

- Several more years of observations of Columbia River post-eruption depositional patterns and dredging requirements have provided better insight into estimating future dredging requirements.

The no-action budget dredging requirements to maintain the navigation channel on the Columbia River, between RM 10 and 72.8 include dredging of a sump at the mouth of the Cowlitz River from 1985 up to 2035. This sump traps flood event sediment and prevents it from disrupting navigation in the Columbia River channel. Approximately 3 mcy/year of sand and fines will be dredged fromthis sump. Due to the geometry of the sump, about 1 mcy of the dredged material will be fines. If the sump were not present, the fines would most likely remain suspended and discharge into the Columbia without depositing.

Observations of the depositional behavior of Cowlitz and Columbia Rivers have led to changes in sediment transport and deposition estimates on those streams. Long-term sediment transport modeling, based on those observations, has resulted in revised flood elevation predictions for the Cowlitz River. Overall, the new design yield reduces the initial intensity of the sediment yields but increases the long-term rates. A full assessment of these changes on possible flood protection and sediment control alternatives are discussed later.

PROBLEM STATEMENT

General

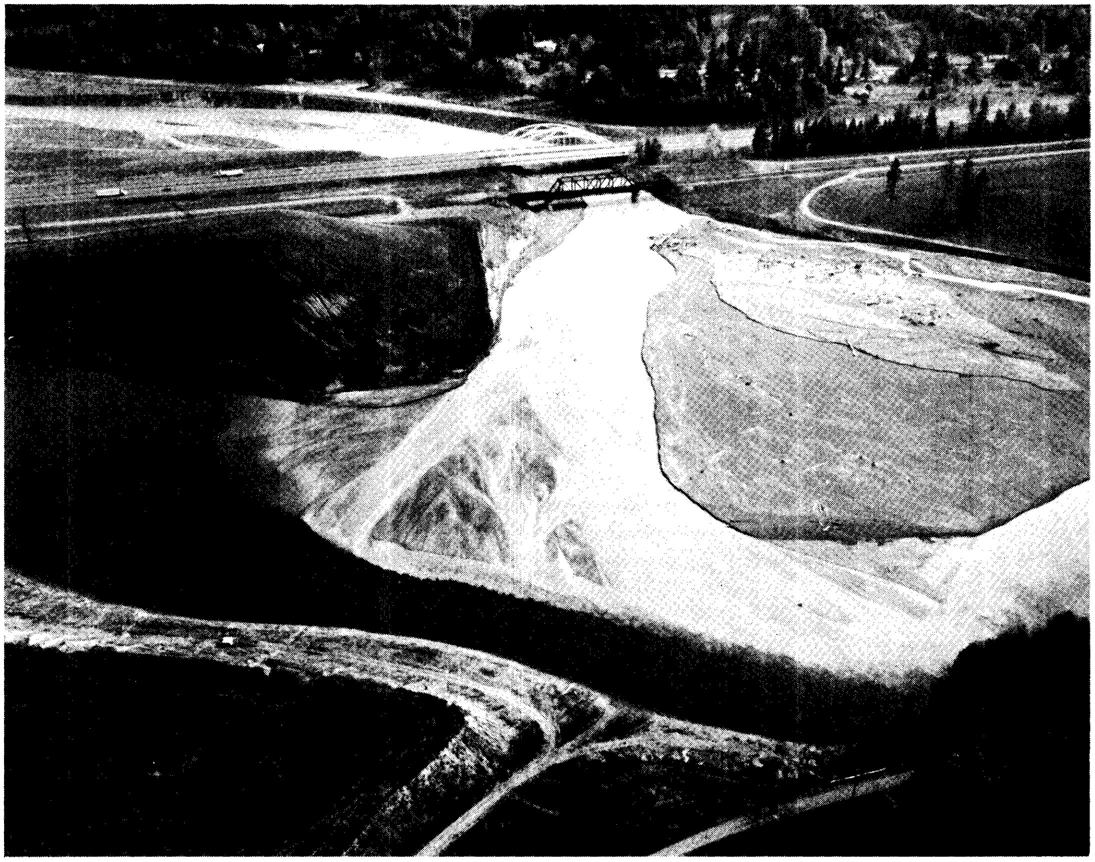
While new estimates have reduced the annual rate of sediment delivery to the Cowlitz, the total sand delivery remains the same as in the Comprehensive Plan: 380 mcy over the study period of 50 years. This changes the potential initial damages, but does not lessen danger to the communities on the Cowlitz, the transportation corridor, or navigation in the Columbia.

As in the Comprehensive Plan, the new analysis gives a conservative damage estimate by assuming total abandonment of communities once major flooding occurs every year; in addition, it includes no cost for actual evacuation, loss of revenue, social impacts to communities, nor secondary economic losses other than direct damages to the region. It further postulates abandonment of all leveed areas under the no-action condition, except Longview. Because of the large investment in the Longview area, abandonment was not an appropriate option.

Potential Flood Damages

Transportation Corridor. Total average annual damages estimated for the transportation corridor which crosses the Toutle River at its confluence with the Cowlitz River come to $12.2 million. Abandonment of the current transportation corridor is not considered a reasonable alternative. However, by 1989, transportation facilities would incur damages annually in excess of $100,000.

Castle Rock. Average annual damages estimated for the city of Castle Rock are $1.9 million. Castle Rock is the most endangered urbanized area with abandonment assumed in 1986. Figure II-6 shows the stage-frequency curve for Castle Rock.



Photograph 7. Sediment Plume from Mouth of Toutle River Entering Cowlitz River.

Lexington. Average annual damages estimated for the community of Lexington are $4.0 million. Damages are not considered for this community beyond 1988 because abandonment is assumed and flooding could be expected on an annual basis after that date.

Kelso. Average annual damages estimated for Kelso are $6.1 million. Abandonment would occur in 1987 and damages are not considered for this community beyond that time.

Longview. Longview is the major damage center for the study area. It contains the industrial base for this region of Washington State. Average annual damages for the city are $102.1 million. As previously stated, abandonment is not assumed for this area. Figure II-7 shows stage-frequency curve for Longview.

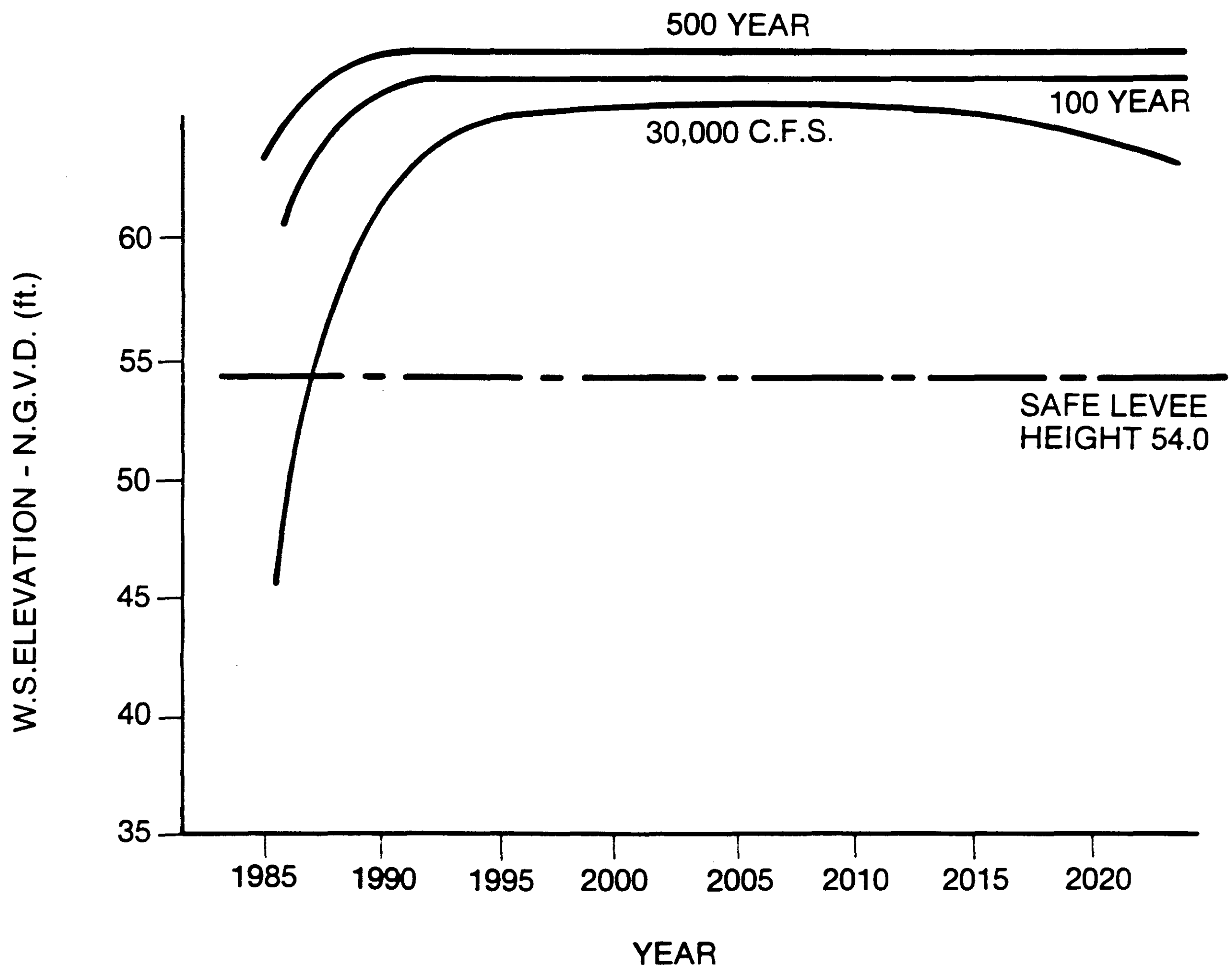


Figure II-6. Water Surface Elevations with no action at Castle Rock - RM 17.6.

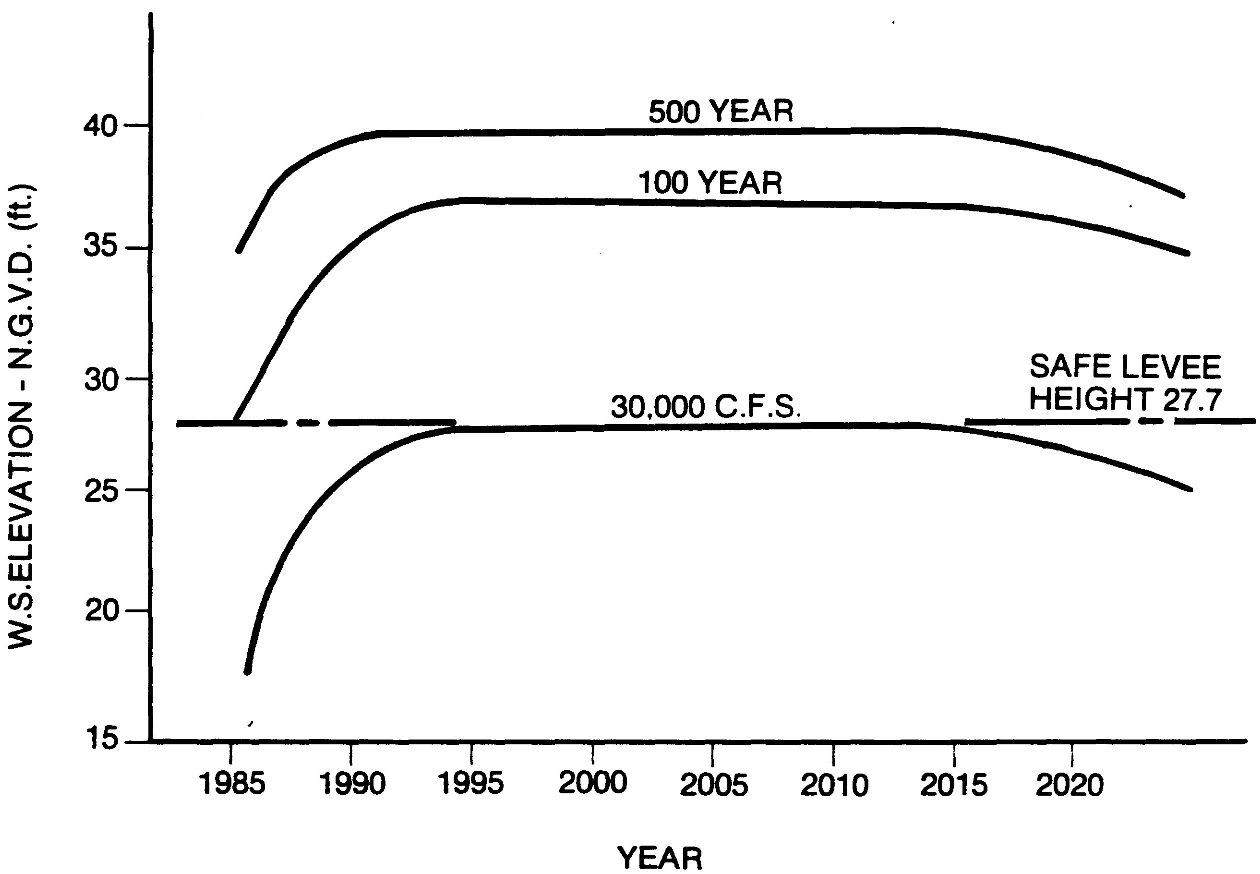


Figure II-7. Water surface elevations with no action at Longview - RM 5.5.

Unleveed Areas. Levees protect all of the above cities or communities in varying degrees. However, damages will occur in the unleveed areas depending on their location. Average annual damages for these areas are $1.2 million. Abandonment will start in 1986 for areas around Castle Rock and in 1987 around the Kelso area.

Total Damages for No Action. Total average annual damages are estimated at $127.5 million.

Columbia River Navigation Impacts

In addition to the damages stated above, the no-action condition affects the maintenance of the Columbia River navigation channel. To the 5.5 mcy per year pre-eruption dredging effort required to maintain the Columbia River navigation channel, a total of 145 mcy of additional dredging will be added for the 50-year life of the project. The incremental average annual cost for this additional dredging is $13.5 million.

Infrequent Events

In addition to the estimated damages and impacts shown above, further threat exists from such infrequent events as mudflows and large storms.

As noted earlier, mudflows and large storm events can deliver so much sediment that the Cowlitz channel would fill and all protection could be lost. Should a mudflow or major storm occur during the storm season, a real possibility exists that the channel capacity could not be restored during the winter season. Severe damages to communities and blockage of the Columbia could result if any storms followed this type of event.

IMPACTS OF NEW SEDIMENT ANALYSIS ON COMPREHENSIVE PLAN SENSITIVITY ANALYSIS

General

The sensitivity analysis conducted in the Comprehensive Plan showed a single retention structure (SRS) is generally the least costly solution to the sediment problem within the total sediment yield range of 400 mcy to 2 bcy. It also indicated that the SRS provided the least costly solution to sediment yields, ranging from approximately 30 mcy/year to 70 mcy/year. The revised sediment budget for the Feasibility Report (see appendix C) placed the new sediment estimates within the approximate range of sensitivities developed for the Comprehensive Plan. The new total sediment yield from the debris avalanche is predicted to be 750 mcy during 55 years beginning in 1980 following the eruption and the declining annual sediment yield is forecast to be 28 mcy in 1985.

This section considers the cost impacts of the revised sediment budget on the relative ranking of sediment solutions and describes additional studies necessary to insure the validity of these relative rankings.

Impacts on Single and Multiple Retention Structures

The revised sediment budget indicated the feasibility of a smaller structure if sized only for sediment storage. However, additional storage needed for sediment delivery by flood events and mudflows dictated that a structure the same size as in the Comprehensive Plan still was required. Continuing investigations of the MRS sites revealed foundation problems, creating increased costs for this option regardless of the magnitude of sediment predictions. Thus, changes in the sediment analysis had no effect on the relative ranking of solutions as presented in the Comprehensive Plan. However, costs have been recomputed for the MRS alternatives and are presented in the following chapter.

Impacts on Sediment Stabilization Basins

The new sediment analysis indicates reduced initial annual sediment delivery, suggesting a lower initial cost for the SSB solutions. However, the total

quantity of sand delivered over the project life remains virtually the same as in the Comprehensive Plan. Since dredging is highly sensitive to total volumes of material removed, costs rise quickly as convenient disposal sites reach capacity. Review of available disposal sites shows little remaining storage volume, indicating that dredging would have greater costs than shown in the Comprehensive Plan. Another factor influencing the cost of the SSB solution stems from a downward revision in the trapping efficiency of this alternative. Increasing the amount of material needing removal adds to the cost. However, investigations will continue considering dredging. Although the SSB terminology is not used, the proposed dredging utilizes the same locations, LT-1 and LT-3, and similar methods of removal.

Further Sensitivity Analysis

Based on the revised sediment budget, investigations were performed to determine if the relative ranking between the MRS and SRS alternatives had changed. The results are presented in the following chapter. Further study also compared various sized SRS's and their accompanying downstream dredging to identify the most cost-efficient combination of structure and dredging at each SRS site. In addition, the National Economic Development (NED) plan formulation process conducted a sensitivity analysis of the impacts of varying quantities of sediment on the proposed plan.

Base Condition

Rationale. As discussed above, a base condition has been selected which is defined as the without-project condition in this report. This base condition acknowledges the Federal Government's commitment to protect the communities along the Cowlitz River and reflects interim actions under authority of PL 98-63. The base condition, rather than the no-action condition, serves as the probable future against which all alternatives will be measured.

Methodology. The Cowlitz River's dynamic nature pointed out the danger of selecting a condition which might prove unachievable on a long-term basis.

Therefore, the Corps chose a condition existing at a given point in time. Since levels of protection on the Cowlitz vary from a high in summer (just after dredging) to a low at the end of winter, the selected base condition was that level of protection documented in the Cowlitz River Survey conducted during November and December 1983. This level of protection was measured against the permanent levees rather than the temporary structures built as a flood-fight activity and considered inadequate as a long-term solution. In sum, the level of protection chosen reflects these factors:

- The interim dredging represents one aspect of a long-term commitment by the Federal Government.

- The November-December survey documented a realistic level of protection. Concern existed that too high a level of protection established against the permanent levees would be impossible to achieve by dredging.

- The November-December 1983 river geometry provides an accurate measurement of river conditions upon which to base damage and benefit calculations.

- The levels of protection existing in the November-December survey, based upon current estimates of sedimentation, vary from about 60-year protection at Longview to 10-year protection at Castle Rock and fall between the maximum and minimum levels achieved that year.

Erosion and sediment transport within the Toutle River Basin will be the same for the base condition as for no action (appendix C). In the Cowlitz River, base condition deposition will be slightly higher than under no action and dredging will be performed at LT-1 and LT-3 to maintain interim flood protection. Dredging also will be conducted at the mouth of the Cowlitz River to maintain the Columbia River navigation channel. A summary of base condition sediment movement is presented in table II-1. As that table shows, 450 mcy of sediment will be transported through the Columbia River system. Over 60 percent of that material will be silt and clay.

TABLE II-1

BASE CONDITION SEDIMENT MOVEMENT

(mcy)

50-year Project Life

(1985-2035)

Estimated Avalanche Erosion		
	750	Total Erosion by 2035
	-99	Previously Eroded
	651	Total 50-Year Erosion
Toutle River	↓	
	651	Yield to
	+23	Erosion
	-89	Deposition (50 upstream gravel +39 dredging)
Cowlitz River	↓	
	585	Yield to
	+10	Erosion
	-74	Deposition (to be dredged)
Columbia River	↓	
	521	Yield to
	0	Erosion
	-71	Deposition (to be dredged)
	↓	
	450	To Move through Columbia River
TOTAL DREDGING REQUIRED	184	

The benefits of the base condition as well as the economic justification used for economic evaluation of alternatives are described in the National Economic Development Plan, chapter IV.

Evaluation of Emergency Structures

In late 1982, the Corps placed temporary structures on the tops of the levees along the Cowlitz River as an emergency measure to improve the margin of safety

against overtopping during the winter of 1982-83 to the leveed areas of Longview, Kelso, Lexington, and Castle Rock. The Corps added between 1 and 5 feet (2.5 feet average) of various construction and structural materials to the top of approximately 10 miles of levees to help offset the uncertainty of winter sediment deposition, expected to exceed 3 feet in the Cowlitz River. None of these emergency measures met Corps design requirements for permanent structures, as this work was designed to provide only additional freeboard for a one-time event. The space available for construction and the safety factor of the existing levee sections determined final temporary levee configurations. Construction materials included quarry waste, sand, concrete stoplogs, highway median barriers, geotextiles, sandbags, and wood. This construction was intended to prevent overtopping of the levees during short-duration events but not to withstand high or long-duration floods or sequential events. Should the levees experience such events, they would suffer damage and need rebuilding before again providing reliable freeboard.

The 1982 emergency actions attempted to provide protecton to structures located in the flood plain behind the levees during the single occurrence of an extreme event. These measures should not be construed as providing the same protection for lives, since temporary evacuation is required as soon as levels reach the safe-water height of the permanent levees. Also, the temporary measures do not provide the same long-term property protection as the permanent structures, because sandbags or other temporary measures are removed once the flood event has passed. However, in the case of the lower Cowlitz River, the Corps left the temporary floodfight measures in place, recognizing that permanent flood control measures would not be implemented for several years and the extreme difficulty in mounting an effective floodfight during the interim period.

As indicated in various interim reports, these emergency measures have provided temporary 100-year emergency protection for the single occurrence of an extreme event. The emergency level of protection is provided by freeboard assumed at 3 feet below the temporary levee crest. By comparison, the safe level of protection for the permanent levee is based on a detailed analysis of the structures and varies from 3 to 6 feet below the crest of the permanent levee. Since the protection provided by the temporary measures and structures is very limited, the levels of protection used in the base condition analysis of this report do

not agree with those given in various interim measures report. A discussion of these levels of protection can be found in appendix D, exhibit 1. Enumerated below are additional reasons these temporary measures are not used as a basis for permanent protection (for explanation of temporary measures, see last paragraph, page II-30).

Since the eruption, an agressive monitoring program on the Cowlitz River provides some preparedness for floodfight operations to protect leveed areas. Based on the existing conditions, it would be impractical to mount successful floodfight operations for all the existing levees for the following reasons:

a. Historically, the Cowlitz River has been difficult to successfully floodfight due to its high velocity and rapid rate of rise. Changes in the Toutle basin watershed due to the eruption of Mount St. Helens have made the Cowlitz even more unpredictable. The National Weather Service feels it can give approximately 6 hours warning of an impending flood peak arrival. From the time the Corps receives a forecast of an impending flood peak and declares a floodfight, it needs over 10 hours of lead time to mobilize contractors and their equipment to protect the threatened areas. Hence, effective floodfight operations could not be mounted in time.

b. Some levees, such as the Castle Rock levees, have no physical room on top of the critical sections to perform floodfights. The space is filled by the temporary raises and no area exists for either equipment or additional protection materials such as sandbags. However, the temporary work is the same as that which would take place in a normal floodfight.

c. In addition to the lead-time requirement listed above, all of the levee systems requiring emergency floodfight operations are crossed by the major evacuation routes leading from low-lying areas or are immediately adjacent to densely inhabited areas. Therefore, it is anticipated that contractor access to many worksites will be seriously inhibited by evacuees attempting to move in the opposite direction away from the threatened areas. This worksite congestion would undoubtedly delay or otherwise interfere with floodfight operations and adversely influence their effectiveness.

A comparison of the base condition levels used for analysis in this report and the level of protection which exist resulting from temporary levees and interim dredging along Cowlitz River are shown below.

Table II-2
COMPARISON OF LEVELS OF PROTECTION

	Levels of Protection*	
Location	Base Condition Used for Analysis	Existing Condition with Temporary Levees and Interim Dredging**
Longview	60 year	100+ year
Kelso	20 year	100 year
Lexington	40 year	100+ year
Castle Rock	10 year	100+ year

*December 1983 survey and August 1984 sediment adjustments.

**Conditions in 1984 approximate those shown in the table above. Based upon the most recent estimates of sediment made during 1984, necessary dredging, and maintenance, rehabilitation, and reconstruction of the temporary emergency protection levees will be accomplished as required by PL 98-63. Levels of protection are subject to variation over the calendar years. See Appendix D, exhibit 1.

e. The Supplemental Appropriations Act of 1983 (PL 98-63) authorized the Corps of Engineers to implement and maintain flood control measures on the Cowlitz and Toutle Rivers. This legislation was enacted to assure flood protection for developed areas in the vicinity of each river against a 100-year flood and to reduce sediment flow into, and the potential blockage of the Columbia River navigation channel.

The emergency levee raises were constructed without benefit of a complete design process. As a result, the emergency structure cross sections are, in many cases, substandard according to current design criteria and do not provide an adequate factor of safety. If the river encroached on these temporary levees, the levees could fail or at least pass so much water as to render them unsafe. Therefore, evacuation of residents has been a requirement as soon as water levels reach the safe water height of the permanent levees.

Use of the emergency structures could result in damages, if implemented as a long-term solution. Moreover, even if the leakage through the structure were solved and the river bed allowed to raise, the old levees underneath the raised sections could become saturated. Since the Corps did not design these structures for continuous saturation, serious interior drainage problems would ensue. At best, this situation would be remedied by costly pumping plants; at the very worst, failure of a section of the permanent levee could occur.

The freeboard provided by the emergency structures was not intended to undergo prolonged inundation. These raised portions are, therefore, not considered a part of the permanent levee except as they provide some tolerance for inaccuracies in predicting water surface elevations during a single storm event. Some benefits are attributable to the freeboard provided by the emergency structures. The Corps evaluation process allows benefits for half the freeboard. A sensitivity analysis presented in appendix B studied whether that additional value would significantly enhance the base condition. The results indicated that it reduced the base condition's residual average annual damages by less than 10 percent. Hence, the impact on plan evaluation of giving the temporary levees benefits as freeboard is considered insignificant.

Costs for Maintaining the Base Condition. The costs shown below reflect the 50-year total and average annual cost required to provide the base condition at 1984 prices using an 8-1/8 percent interest rate. The detailed costs by year are shown in exhibit 1 of appendix D. By comparison, 1983-84 dredging costs to remove 12.4 mcy came to $22.5 million.

Monitoring Cost	$ 32,500,000
Toutle River Dredging (37 mcy)	68,200,000
Cowlitz River Dredging (76 mcy)	219,700,000
Columbia River Dredging (71 mcy)	170,700,000
Contingency (20%)	98,100,000
TOTAL COST	$589,200,000
AVERAGE ANNUAL COST	$ 23,300,000

Risks Associated with Base Condition. Certain risks are inherent with any dredging solution. Dredging is primarily a reactive measure. Monitoring indicates when the protection to a community would warrant dredging. If the level of protection is measured during the summer, there is little problem; but if it decreases during the storm season, there is little chance of restoring full protection before the end of the winter.

If all the dredging were done continuously at LT-1 and LT-3 sites, there would be a limitation to site efficiency and not all the sediment moving through the river could be removed. This is due to physical limits on how much material can be handled by dredging equipment in a given period of time; moreover, the sediment delivered by one storm could fill or exceed the capacity of a basin. Since storms in this region can occur in series, a second storm could bring another wave of sediment before the basin could be dredged of the earlier deposit. As a result, only part of the sediment being transported could be trapped and removed under these conditions. A large volume of sediment could pass into the lower Cowlitz and Columbia Rivers, creating a potential for flooding on the Cowlitz and blockage of navigation on the Columbia.

Conclusions

As described, the problem statement for the feasibility study reflects recent changes to the sediment budget. The problem statement fully acknowledges the serious continuing threat to communities on the Cowlitz River, to the transportation corridor crossing the Toutle River, and to navigation on the Columbia River. Originally, the problem statement assumed a no-action condition. This did not reflect the Federal commitment to protect threatened communities, as

indicated by the interim dredging authorized under PL 98-63. The revised problem statement uses as the base condition a without-project status but presumes continued dredging.

The without-project base condition is now the point of comparison for all future alternatives in this report. The damages claimed for those alternatives will reflect only those damages which exceed the base condition, since the benefit of each alternative is based on the net difference from the base condition (see chapter IV). All future discussions of alternatives and their costs must reflect the protection provided by the base condition.

Investigations performed on the sensitivity analysis conducted in the Comprehensive Plan showed no change in rankings. Further sensitivities have been conducted on the retention structure alternatives and the dredging required to maintain the base condition. These identified the ranges in cost, should sediment delivery vary significantly from the revised estimate.

A developed area will be deemed as having 100-year flood protection when the predicted 100-year flood elevation is 3 feet or more below the top of the levee. The top of the levee is considered to be the higher of either the top of the permanent levee or the top of the temporary levees that were constructed on the permanent levees during the winter of 1982-83, depending on location. This 100-year protection is considered adequate for protection of property only. Since these temporary levee raises could not be constructed to Corps standards because of time limits and rights-of-way constraints, they do not offer the same degree of proteciton of life as standard Corps levees. This is particularly true in the Castle Rock area where evacuation will be necessary prior to reaching the 100-year flood elevation to insure adequate protection of lives.

CHAPTER III - FURTHER INVESTIGATIONS

INTRODUCTION

Following the development of the revised sediment budget, new cost estimates were formulated to recheck the relative ranking between the MRS and SRS alternatives. These new estimates not only considered the revised sediment projections, but also looked at new site information developed since completion of the Comprehensive Plan. Specifically, the new estimates incorporated information from foundation studies and topographic surveys conducted at LT-3 and Kid Valley sites, similar to ones already completed at the Green River site.

This chapter presents new costs for all the MRS combinations and compares the structures and associated costs with the SRS alternative. It also carries out a cost comparison between different sized structures at all SRS sites.

MULTIPLE RETENTION STRUCTURES (MRS) COST REVISIONS

Description

This study examined the proposal for two or three structures placed along the North Fork and main stem Toutle Rivers, sized to store the materials eroding from the debris avalanche. The structures would be constructed in sequence and would not require dredging of the material trapped by the structures.

Sites available for constructing debris retention structures exist at LT-3, Kid Valley, and Green River. Initial construction would begin at the lower site on the river, LT-3; and structures would be added upstream until sufficient storage existed to handle the eroded material.

The heights of the structures would vary, depending on the amount of material retained at a given location. All structures would be built in a single stage although the larger structures at Kid Valley and Green River could be built in stages. These retention structures would be gravity dams constructed using

roller-compacted concrete techniques. The spillway, also roller-compacted concrete, would have gravity sidewalls with a raised concrete overflow section to control the level of sediment deposition behind the structure. The phasing of subsequent dams would depend upon the full utilization of the preceding structure's storage space.

This strategy would limit the operations and costs required to remove material, as long as the structures have sufficient storage capacity to capture all the sands eroding from the debris avalanche. Construction in sequence allows flexibility in dealing with sediment movement. Downstream dredging would be required to handle sediment transport during construction of the first retention structure, and for several years thereafter, until the river system downstream of the structures stabilizes.

Results

Foundation explorations revealed that LT-3 required considerably more excavation than preliminary estimates. Moreover, new studies showed the need for additional foundation work for the left abutment at the Green River site. New topographic information at LT-3 called for saddle dams along the ridgeline of the basin to take full advantage of the capacities estimated for that site. These structures are necessary to prevent flows from diverting to other adjacent basins as they overtop the low spots of the Toutle Basin around LT-3. Detailed topography studies also improved storage estimates for the Kid Valley site.

The estimates in table III-1 are based on the revised sediment budget. They provide at least the same protection given by the base condition assumed for this report. The MRS estimates yield benefits equal to the lowest cost SRS, the 177-foot-high Green River structure, based on average annual sediment deliveries.

Other Considerations

Relocations. Real estate costs and land requirements are greater for multiple sites than for single sites. Impacts associated with acquisition are also multiplied because of the increased number of land owners involved.

Fisheries. Under the MRS plan, the first structure built is LT-3. This effectively cuts off upstream fish migration. With each additional structure, chances of successful upstream movement for fish becomes more remote. Downstream migrants also suffer higher mortalities under the MRS option. Greater impacts occur to wildlife habitat for multiple structures than for single structures. State and Federal wildlife agencies oppose multiple structures.

Summary

All combinations of the MRS shown are based on the most recent sediment, foundation and topographic information. These combinations provide at least the base condition level of protection and have outputs or benefits equal to the SRS shown. Both in total and average annual costs, the SRS clearly represents the more cost-efficient solution. Therefore, the MRS alternative is dropped from the formulation process and all further comparisons will consider only the SRS and dredging for the base condition.

Clearly, the total costs associated with MRS structures are high. In order to compare the MRS combinations with the SRS, the study sized the SRS so that its downstream actions equaled those of the MRS. This resulted in equal benefits of flood damage reductions and equal reductions to dredging on the Columbia River. Table III-1 shows that comparison.

Table III-1
MRS-SRS Cost Comparison [1]

Combination (Dam height)	Structure Cost[3] ($ M)	Structure Storage (mcy)	Downstream Action Costs: Cowlitz Toutle[2] ($ M)	Downstream Action Costs: Columbia[2] ($ M)	Total ($ M)	Average Annual ($ M)
MRS						
LT-3 (132 ft)	134.2[3]	34				
Kid Val. (268 ft)	236.0	248				
O&M/Monitoring	42.0					
			64.1	33.1	509.4	30
LT-3 (132 ft)	134.2[3]	34				
Kid Val. (118 ft)	79.0	19				
Green R. (153 ft)	137.9	184				
O&M/Monitoring	39.0					
			64.1	33.1	487.3	28
LT-3 (132 ft)	134.2[3]	34				
Green R. (163 ft)	143.7	259				
O&M/Monitoring	42.0					
			64.1	33.1	417.1	25
Kid Val. (118 ft)	79.0	19				
Green R. (168 ft)	148.0	279				
O&M/Monitoring	42.0					
			64.1	33.1	366.2	22
SRS						
SRS at Green R.						
Green R. (177 ft)	150.0	299				
O&M/Monitoring	45.0					
			64.1	33.1	292.2	18

[1] Exact comparison between MRS and SRS costs at each site cannot be made as differences in O&M and monitoring costs exist under the two schemes.

[2] All projects have equal downstream action requirements and costs.

[3] Does not include $60 million for saddle dam at LT-3, since constructing a dam upstream limits the amount of additional aggregation behind the structure and negates the need for such a dam. The SRS does include a saddle dam in its costs.

SINGLE RETENTION STRUCTURE SITE DEVELOPMENT

General

Following the development of the revised sediment budget and the decision to concentrate on the SRS, a refined methodology identified a general area of optimization between downstream actions and structure size. The analysis considered a wide range of structure sizes for each SRS site. The study then compared total project costs, including dredging on the Cowlitz and Columbia Rivers for each size of structure at each site. An optimized structure would be one having a total project cost less than either the next smaller or next larger structure.

Description

Structure. Structures developed for the following cost estimates would be built of roller compacted concrete with a concrete spillway. The size of the structures vary depending on the sites. Spillways are 600 feet wide at all sites except LT-3, where site limitations permit a width of only 500 feet.

Spillways would empty into stilling basins constructed of concrete. Some form of regulating outlet has been assumed for all but the smallest structures with the cost for an intake tower included in the estimates. Structure design includes fish by-pass facilities for anadromous fish as discussed in Section V.

The trap efficiencies of the structure vary in relation to their size and sediment capacities and retention times. These varying efficiencies are reflected in the costs of downstream actions and are included in the total project costs. All structure costs shown below assume one-stage construction. Analysis will be performed on the preferred plan for staging feasibility.

Downstream Actions. Most downstream dredging would occur on the Toutle River at LT-1 and possibly LT-3. Once the disposal areas for those sites are full or because of some threat to a community, dredging would take place on the Cowlitz. Cost of a monitoring program for the sediment movement is included in the project costs. This monitoring program is critical for identifying dredging locations on the Cowlitz River during the first few years of the project's life. Costs for dredging include real estate for disposal areas and necessary hauling of material.

Engineering considerations include dredging in the Columbia at the mouth of the Cowlitz River. Costs reflect disposal in areas close-by until those areas become full and additional expenses are incurred for transporting material to more distant locations. It is anticipated that material not deposited at the mouth of the Cowlitz will have little impact downstream in the Columbia.

Costs. Costs for all alternatives include real estate, contingency, engineering and design, and supervision and administration. Detailed costs are found in appendix D.

LT-3

General. As previously discussed, foundation explorations discovered greatly increased construction costs for all sizes of structures at this site. Questionable foundation conditions exist along the ridgeline between the Toutle River and Salmon Creek basins, requiring the use of saddle dams. This site has very limited capacity. Costs for an SRS at the LT-3 site are shown in table III-2.

Table III-2

LT-3 Site

Dam Height (ft)	Maximum[1] Capacity (mcy)	50-Year[2] Trapping Capability (mcy)	Structure Costs ($M)	Downstream Actions Cowlitz/ Toutle $ (mcy)	Downstream Actions Columbia $ (mcy)	Total Costs[3] ($M)
107	21	21	119.1	326.2 (98)	193.5 (68)	638.7
132	73	73	225.7	255.1 (80)	185.0 (65)	665.8
162	169	147	398.0	172.1 (59)	158.0 (57)	728.0
BASE CONDITION						589.2

1. Capacity based on a pool with an S/2 upstream material slope.
2. Trapping capability based on 50-year project life and average annual sediment delivery.
3. Price level 1984.

Real Estate Requirements. The range of real estate requirements are shown in table III-3.

Table III-3

LT-3 Real Estate Requirements[1]

Dam Height (ft)	Acreage	Number of Ownerships	Number of Occupied Improvements	Total Real Estate Costs
107	1,410	73	13	6,350,000
162	2,870	92	13	13,900,000

1. Real estate costs included in Table III-2.

Other Considerations.

a. Saddle Dams. These structures are costly to build and would require further foundation investigations at this site.

b. Fishery Impacts. Fishery impacts would occur because fish migration to both Green River and the South Fork Toutle, which have important fisheries, would be blocked. Environmental interests have concerns about any structure below the confluence of the Green River. State and Federal agencies opposed this site for a structure.

Kid Valley Site

General. A high dam is required in this area because of the narrow shape of the valley; however, adequate capacity exists at this site. A structurally competent foundation exists.

Table III-4

Kid Valley Site

Dam Height (ft)	Maximum[1] Capacity (mcy)	50-Year[2] Trapping Capability (mcy)	Structure Costs ($M)	Downstream Actions: Cowlitz/ Toutle $ (mcy)	Downstream Actions: Columbia $ (mcy)	Total Costs[3] ($M)
118	35	35	112.0	267.7 (97)	187.2 (66)	575.9
163	87	87	149.0	203.7 (78)	170.5 (61)	523.2
208	174	174	187.7	114.9 (52)	154.8 (55)	457.4
243	281	270	238.1	64.1 (29)	126.4 (47)	428.6
318	726	463	306.0	59.7 (27)	33.1 (15)	398.8
BASE CONDITION						589.2

1. Capacity based on a depositional area with an S/2 upstream material slope.
2. Trapping capability based on 50-year project life and average annual sediment delivery.
3. Price level 1984.

Real Estate Requirements. The range of real estate requirements for Kid Valley site are shown on table III-5.

Table III-5

Kid Valley Real Estate Requirements[1]

Dam Height (ft)	Acreage	Number of Ownerships	Number of Occupied Improvements	Total Real Estate Costs
118	1,700	46	10	$ 5,800,000
318	7,000	94	34	20,850,000

1. Real estate costs included in table III-4.

Other Considerations.

a. Fishery Impacts. Significant impact to upstream fisheries would occur with a structure at this site. Fisheries agencies oppose any structures below confluence of Green River. Sediment backup would affect fisheries on both the Green River and the North Fork Toutle River.

b. Relocations. No utilities relocations are proposed for alternatives with dam heights greater than 208 feet, since real estate acquisitions preclude the need for such actions. However, relocation of State highway 504, which runs parallel to the North Fork Toutle at the Kid Valley and Green River sites, may be necessary. See chapter X for further discussion.

Green River Site

General. A structurally competent foundation also exists here, as well as adequate capacity.

Table III-6

Green River Site

Dam Height (ft)	Maximum[1] Capacity (mcy)	50-Year[2] Trapping Capability (mcy)	Structure Costs ($M)	Downstream Actions: Cowlitz/ Toutle $ (mcy)	Downstream Actions: Columbia $ (mcy)	Total Costs[3] ($M)
77	40	40	107.8	290.6(100)	187.2 (66)	585.6
112	113	112	147.5	184.0 (73)	170.5 (61)	502.0
142	234	184	171.4	92.8 (42)	145.3 (50)	409.5
177	411	299	195.0	64.1 (29)	33.1 (15)	292.2
202	581	395	226.3	59.7 (27)	33.1 (15)	319.1
272	1162	463	310.9	59.7 (27)	33.1 (15)	403.7
BASE CONDITION						589.2

1. Capacity based on a depositional area with an S/2 upstream material slope.
2. Trapping capability based on 50-year project life and average annual sediment delivery.
3. Price level 1984.

Real Estate Requirements. The range of real estate requirements for Green River site are shown on table III-7.

Table III-7
Green River Real Estate Requirements[1]

Dam Height (ft)	Acreage	Number of Ownerships	Number of Occupied Improvements	Total Real Estate Costs
77	1,500	18	7	$ 4,000,000
272	8,700	24	9	17,300,000

1. Real estate costs included in table III-6.

Other Considerations.

a. Fishery Impacts. This structure would have no negative impact on fish movement or habitat of the Green and South Fork Toutle Rivers. Fish migration upstream of the SRS is affected. Agencies favor this site with some form of fish passage provided.

b. Relocations. No utilities relocations are proposed for alternatives with dam heights greater than 142 feet, since real estate acquisitions preclude the need for such actions. However, relocations of State highway 504, which runs parallel to the North Fork Toutle at the Kid Valley and Green River sites, may be necessary. See chapter X for further discussion.

Table III-8

Summary of Costs

Site and Dam Height (ft)	Maximum[1] Capacity (mcy)	50-Year[2] Trapping Capability (mcy)	Structure Costs ($M)	Downstream Actions: Cowlitz/ Toutle $ (mcy)	Downstream Actions: Columbia $ (mcy)	Total Costs ($M)
LT-3						
107	21	21	119.1	326.2 (98)	193.5 (68)	638.7
132	73	73	225.7	255.1 (80)	185.0 (65)	665.8
162	169	147	398.0	172.1 (59)	158.0 (57)	728.0
Kid Valley						
118	35	35	112.0	267.7 (97)	187.2 (66)	575.9
163	87	87	149.0	203.7 (78)	170.5 (61)	523.2
208	174	174	187.7	114.9 (52)	154.8 (55)	457.4
243	281	270	238.1	64.1 (29)	126.4 (47)	428.6
318	726	463	306.0	59.7 (27)	33.1 (15)	398.8
Green River						
77	40	40	107.8	290.6(100)	187.2 (66)	585.6
112	113	112	147.5	184.0 (73)	170.5 (61)	502.0
142	234	184	171.4	92.8 (42)	145.3 (50)	409.5
177	411	299	195.0	64.1 (29)	33.1 (15)	292.2
202	581	395	226.3	59.7 (27)	33.1 (15)	319.1
272	1162	463	310.9	59.7 (27)	33.1 (15)	403.7

1. Capacity based on a depositional area with an S/2 upstream material slope.
2. Trapping capability based on 50-year project life and average annual sediment delivery.

Summary

Of the 14 various sized structures considered, the 177-foot-high SRS at Green River is the least costly. The following chapter will examine the benefits of each of these structures and identify the one which provides the maximum net benefits. By definition, it will become the NED plan.

CHAPTER IV - NATIONAL ECONOMIC DEVELOPMENT (NED) PLAN

GENERAL

The Comprehensive Plan screened thirteen alternative measures and eliminated all but five. The five management strategies identified during plan formulation constituted the most feasible alternatives for meeting the study objectives and providing a long-term solution to the potential threat of flooding and navigation channel blockage.

The formulation process assumed that the existing Columbia River navigation channel would continue to be maintained to its 40-foot authorized depth, with any flood protection alternative evaluated. This navigation channel is a significant regional transportation resource which carries some 30 million tons of commerce annually. Political, social, and economic considerations warrant the maintenance of this navigation channel under all project conditions.

In the Comprehensive Plan, each management strategy was designed to yield the same benefits, or level of protection, measured against a no-action condition. Comparison was made of the various measures based upon cost of implementation to determine which of them yielded the greatest net benefit. Based upon this analysis, single retention structures (SRS) cost substantially less than any of the alternative measures considered while providing the same level of benefits.

Subsequent analyses tested the sensitivity of single retention structures to changes in the anticipated rate of sediment erosion and to greater and lesser total volumes delivered over the study period. This sensitivity analysis showed that single retention structures, by virtue of their storage capacity, provided the greatest allowance for variation in total volume and for changes in the rate of sediment erosion and transport to the downstream channel. It also confirmed that SRS's were relatively insensitive to shifts in total volume and rate of delivery.

Following the above analysis, the Feasibility Report focused on single retention structures for further evaluation and refinement.

BASE CONDITION

The base condition defined for this Feasibility Report is the channel capacity existing in the Cowlitz River as established by an onsite survey performed in November-December 1983. This capacity represents a constant level of protection which is sustainable over the long run through ongoing dredging activities. This interim dredging was authorized by PL 98-63 and is consistent with the recent levels of funding for Cowlitz River dredging. Therefore, the base condition fully represents the without project condition described in the Water Resource Council's Principles and Guidelines. It is the condition against which all alternatives are compared. Figures IV-1 and IV-2 show the water surface elevations for Castle Rock (RM 17.6) and Longview-Kelso (RM 5.5), respectively, under base condition measures.

The water surface elevations for the base condition are to remain constant, not only during ongoing dredging activities, but also in the future when the Cowlitz River stabilizes. The amount of interim dredging is determined by actual deposition. Therefore, sediment removal can be annually adjusted to maintain a constant level of protection or water surface elevation. This level, resulting from PL 98-63 sediment removal will be maintained by the natural stabilization of the river in the future when channel deposition is offset by erosion.

The evaluation process contained in this study examines the impact of each alternative SRS upon the base condition, both in terms of reducing flood damages and in preventing blockage of the navigation channel. This is a reasonable approach because any action which reduces sediment movement into the Cowlitz and Columbia Rivers addresses both flood control and navigation problems. The final screening of alternatives to identify the NED plan includes the impact each alternative will have on the costs of maintaining the Columbia River navigation channel and the degree of flood protection afforded along the Cowlitz River.

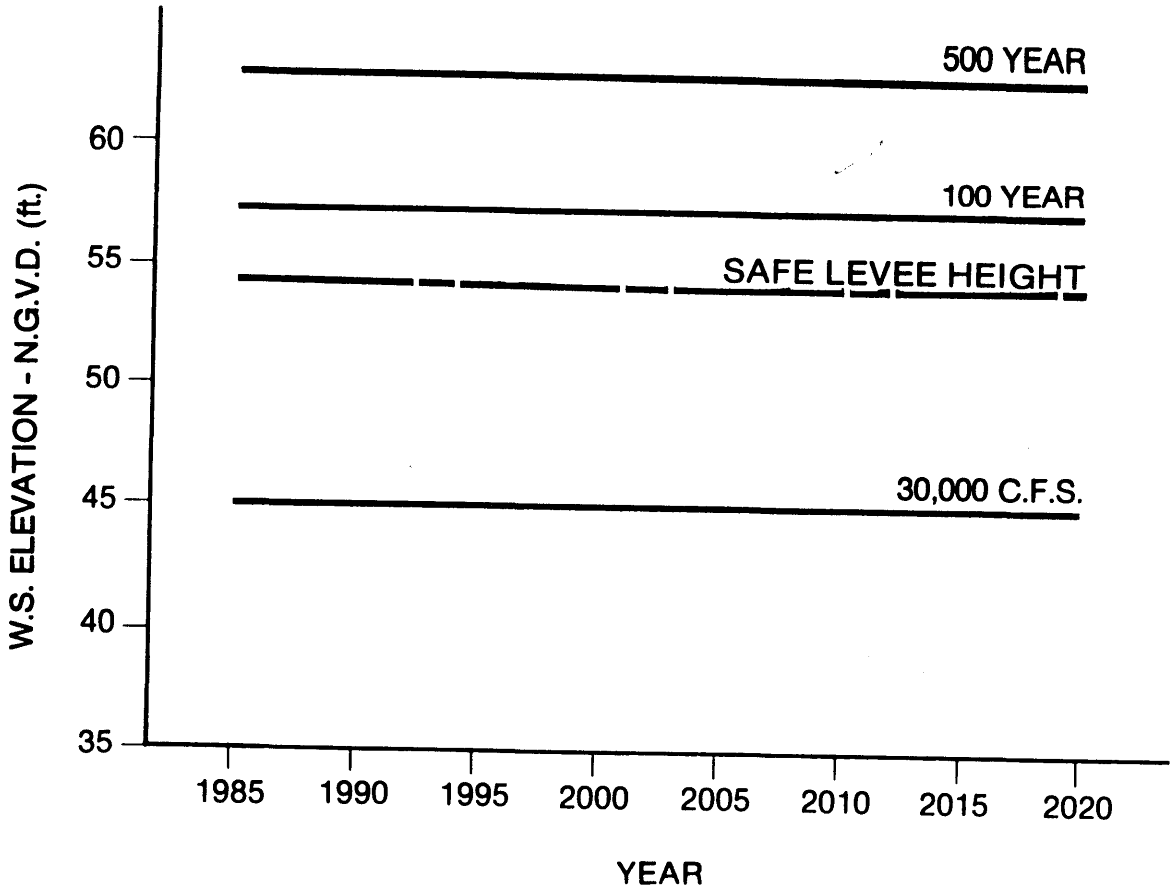


Figure IV-1. Water surface elevation for base condition at Castle Rock (RM 17.6)

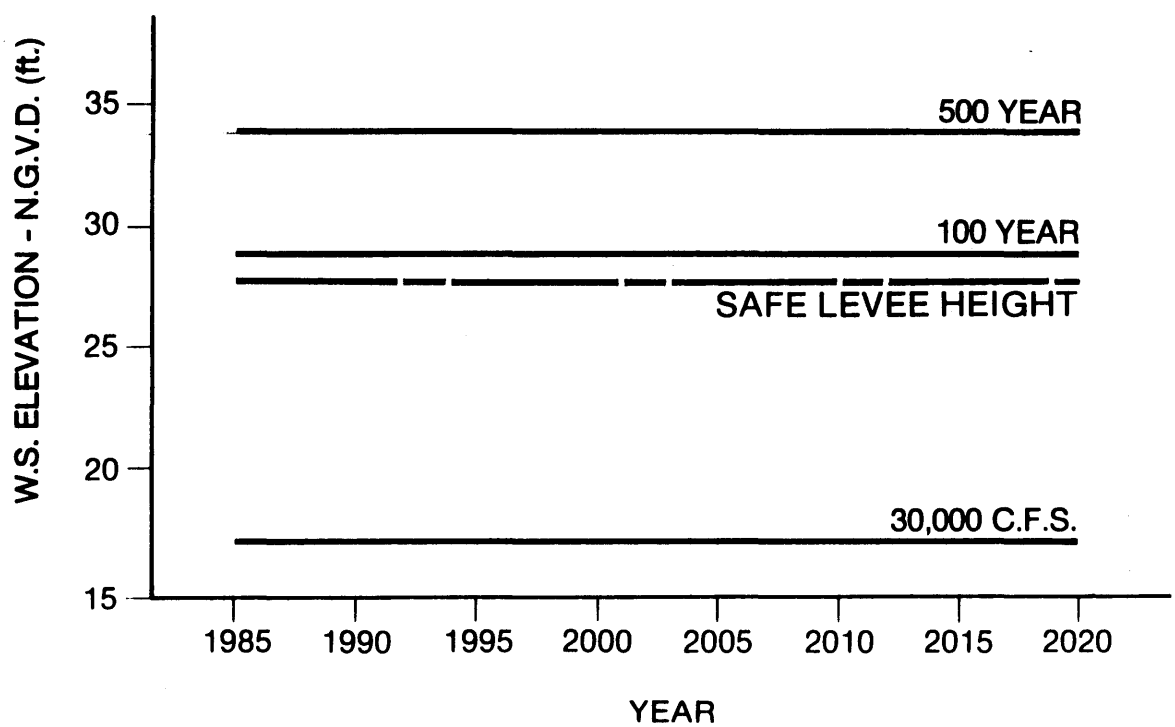


Figure IV-2. Water surface elevation for base condition at Longview-Kelso (RM 5.5).

Justification for Base Condition

Adoption of the previously defined base condition required economically justifying the interim dredging costs incurred for maintaining this condition. Dredging quantities and costs for the project life are given in exhibit 5 of appendix D. The analysis developed a no-action scenario which assumed no additional flood reduction measures would be undertaken subsequent to December 1983. A comparison over time between the no-action status and the base condition established the level of expenditures necessary to maintain a constant (base) level of protection. The resulting difference in flood damages between the no-action and base condition represents damage reductions attributable to interim measures maintaining the base condition at a constant level.

Under a no-action scenario, annual flood damages would rise steadily over the next 4 to 5 years. Damage estimates were computed for each successive year until a .95 probability of reoccurrence was reached. At this point, annual inundation would dictate abandonment of existing improvements as damages incurred each year would be equal to or greater than their annualized value.

Average annual net benefits of $105 million result from maintaining the base condition instead of the no-action status. These benefits consist of flood damage reduction amounting to $120.4 million averaged annually as shown in table IV-1. The base condition also reduces Columbia River dredging costs of $13.5 million in the no-action condition to $5.6 million, for a $7.9 million average annual savings. The benefits are compared with average annual costs of $23.3 million to maintain the base condition. Costs associated with dredging are shown in appendix E, table E-4. Residual average annual damages, which remain under the base condition, amount to $7.1 million annually as shown in table IV-1.

Table IV-1

Residual Damages

Reach	Equivalent Average Annual Damages No-Action	Equivalent Average Annual Damages Base Condition
Longview	$102,109,400	$ 181,200
Kelso	6,144,600	2,382,400
Unleveed	69,400	68,000
Lexington	4,001,800	623,800
Unleveed	523,400	778,500
Castle Rock	1,849,000	1,668,300
Unleveed	573,800	1,325,000
Major Transportation Facilities	12,233,000	123,200
Total	$127,504,400	$7,150,400

Description of Flood Damages - Base Condition

Although interim measures will be undertaken to maintain the base condition, the volatile and dynamic sediment movement into the Cowlitz River prevents eliminating all possible flooding and damages Residual damages will result from flood events which exceed base condition levels of protection for leveed and unleveed areas. The base condition levels of protection for leveed areas are shown below. A comparison between the base condition and interim measures is contained in chapter II.

	Base Condition 1983 Level of Protection
Castle Rock	10-year
Lexington	40-year
Kelso	20-year
Longview	60-year

WITH-PROJECT CONDITION

The with-project condition consists of plans or measures which will improve upon the base condition previously described and address the two major study objectives relating to transport and deposit of sediment into the Cowlitz and Columbia Rivers. The benefit of each alternative is based on the net difference from the base condition.

Benefits realized under a with-project condition include reductions in the $7.1 million residual average annual flood damages, savings in costs required to maintain the Columbia River navigation channel, and savings in dredging costs currently required to maintain the base condition on the Cowlitz River. The costs no longer incurred for dredging to maintain the base condition amount to a savings of $23.3 million annually.

Single Retention Structure

As described earlier, the formulation and evaluation process contained in the Comprehensive Plan identified single retention structures as the most efficient and effective solutions. Sensitivity analyses likewise indicated that these structures would yield the highest net return in terms of economic efficiency over a considerable range of sediment volumes.

Subsequent to the Comprehensive Plan, additional design work refined the cost and structural criteria of SRS. These studies determined that single-staged, rather than incrementally-staged construction was still cost effective. A discussion of staging versus single-stage construction is found in appendix D.

This report utilizes the revised sediment projections and delivery rates to confirm that a single retention structure still represents the optimum solution.

The analysis evaluates various sizes of single retention structures, each constructed to a specific design elevation in a single construction phase. Three locations in the upper Toutle River watershed (LT-3, Kid Valley, and Green

River) are studied. Each option and its costs are shown below. Given the revised estimates of total delivery and changes in delivery rates, reanalysis of the original plans or management strategies affirm that single retention structures are the most cost efficient plan.

Table IV-2

Summary of Costs

Site and Dam Height (ft)	50-Year[1] Trapping Capability (mcy)	Structure Costs ($M)	Downstream Actions Costs ($M)	Downstream Actions Volume (mcy)	Total Costs ($M)	Average Annual Costs ($M)
LT-3						
107	21	119.1	519.6	166	638.7	26.7
132	73	225.7	440.1	145	665.8	27.8
162	147	398.0	330.0	116	728.0	34.0
Kid Valley						
118	35	112.0	463.9	163	575.9	23.5
163	87	149.0	374.2	139	523.2	21.8
208	174	187.7	269.7	108	457.4	20.8
243	270	238.1	190.5	76	428.6	22.2
318	463	306.0	92.8	42	398.8	26.2
Green River						
77	40	107.8	477.8	166	585.6	23.9
112	112	147.5	354.5	134	502.0	20.3
142	184	171.4	238.1	95	409.5	18.0
177	299	195.0	97.2	44	292.2	17.9
202	395	226.3	92.8	42	319.1	20.0
272	463	310.9	92.8	42	403.7	25.8
BASE CONDITION[2]			589.2	184	589.2	23.3

1. Trapping capability based on 50-year project life and average annual sediment delivery.
2. Level of protection varies with area. Under the base condition, comparisons varied from 60-year level of protection at Longview to 10-year level protection at Castle Rock.

Identification of NED Plan

The NED plan is the measure which provides the greatest net benefit to the nation's economy. As with the preliminary screening process and subsequent

ordering of alternatives, maximization of net benefits guides the process of siting and sizing the SRS and identification of the NED plan.

The costs considered in the analysis consisted of all site preparation and construction expenditures expressed in terms of annual amounts over a 50-year period. The analysis also presents cost estimates for dredging and disposal of sediment accumulating in the Columbia River channel for each alternative under both the base and with-project conditions. These costs are likewise expressed in equal annual amounts. The difference in costs between the base condition and with-project condition for each alternative structure represents the benefit or dollar savings each year for each alternative.

Average annual flood control benefits are directly related to the volume of sediment removed and subsequent impact on water surface elevations in the Cowlitz River. Based upon the total amount of sediment movement projected and the annual rate of delivery to Cowlitz River, benefits for flood damage prevention are computed both for the base condition and for each alternative plan of the with-project condition.

The analysis uses the following procedure in measuring flood control benefits. It applies stage-damage analysis to leveed and unleveed areas from the Cowlitz River mouth to the confluence of the Cowlitz and Toutle Rivers to measure potential damages for a range of flood events. It delineates by type, location, and ground floor elevation, all improvements in the flood plain. The value of structures and contents are determined from tax assessment records, valuation formulae applied to contents, or individual appraisals. Depth-damage data from the Federal Insurance Administration and depth-damage relationships developed for Portland District by an engineering consulting firm supply the base for computing damages at various flood levels. The hydrology component of the analysis assumed normal water year conditions.

The next step of the analysis develops stage-damage curves for 8 subreaches along the lower 25 miles of the Cowlitz River, including I-5 and BNRR bridges, highway and rail lines. Data from the stage-damage curves are then integrated with stage frequency curves having a probability of occurrence ranging from annual (.95 probability) to 1 in 500 years (.002). Appendix E presents the

stage-damage methodology in detail. The analysis measures flood damages in constant dollars. In fact, all costs and benefits in this report reflect current 1984 dollars. For purposes of discounting costs and benefits incurred in future years, the current Federal interest rate of 8-1/8 percent is applied.

Flood control benefits developed for each SRS alternative using the above method are somewhat understated in that no credit is given for the capability of SRS to reduce flood peaks during the early life of the project. Some reduction in flood peaks would be accomplished by storing floodwaters, allowing the settlement of material. The large SRS have greater storage capability and consequently would realize more of these incidental benefits. Furthermore, implementation costs associated with temporary evacuation measures are not included in residual damage estimates under the base condition. Moreover, the costs resulting from disruption of waterborne commerce on the Columbia River channel have not been included.

Given the criteria outlined above and based upon evaluation of the data in this study, the NED solution is a single retention structure 177 feet high at the Green River site. This plan is selected for the following reasons: (a) it best meets the requirements of national economic development, yielding the greatest net benefits of all plans considered; and (b) it also has the physical capability to contain most of the material projected to be carried into the Cowlitz and Columbia Rivers over the 50-year project life. It also would cause the least disruption of the physical environment and related resources.

Of the alternative sites and various spillway height elevations considered, the SRS at Green River provides the most effective and efficient solution, given the total volume of material and rate of infill anticipated over a 50-year period. Chapter V describes the physical details of the structure. Until completed, interim annual dredging of sediment from the Cowlitz River would continue, maintaining existing channel capacity and level of flood protection in conformance with PL 98-63 (base condition).

The impact of the preferred plan on sediment movement is summarized in table IV-3 and described in detail in appendix D. By trapping 299 mcy of sediment

behind the SRS, the dredging requirements are reduced to 44 mcy from 184 mcy under the base condition. The reduction in sediment entering the Cowlitz River will cause erosion of the existing sediments and result in lower water surface elevations at Castle Rock and Longview-Kelso as shown on figures IV-3 and IV-4.

TABLE IV-3

PREFERRED ALTERNATIVE SEDIMENT MOVEMENT

(MCY)

50-Year Project Life

1985 - 2035

ESTIMATED AVALANCHE EROSION		
	750	TOTAL EROSION BY 2035
	-99	PREVIOUSLY ERODED
	↓	
	651	TOTAL 50-Year EROSION
TOUTLE RIVER	↓	
	651	YIELD TO
	+23	EROSION
	-328	DEPOSITION (299 SRS RETENTION* + 29 DREDGING)
	↓	
COWLITZ RIVER		
	346	Yield to
	+10	Erosion
	0	DEPOSITION
COLUMBIA RIVER	↓	
	356	YIELD TO
	0	EROSION
	-15	DEPOSITION (TO BE DREDGED)
	↓	
	341	TO MOVE THROUGH COLUMBIA RIVER
TOTAL DREDGING REQUIRED	44	

* - ASSUMES OPERATION EFFECTIVENESS 1987

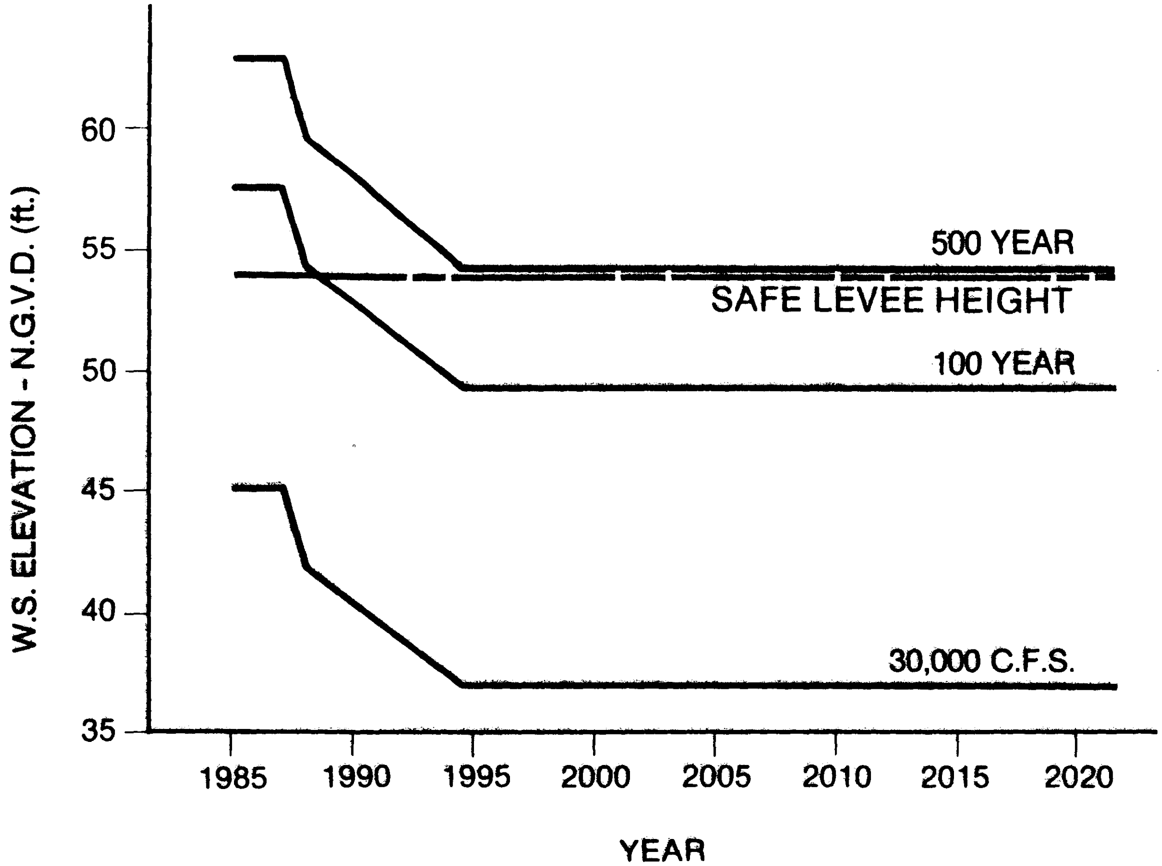


Figure IV-3. Water surface elevation for NED plan at Castle Rock (RM 17.6).

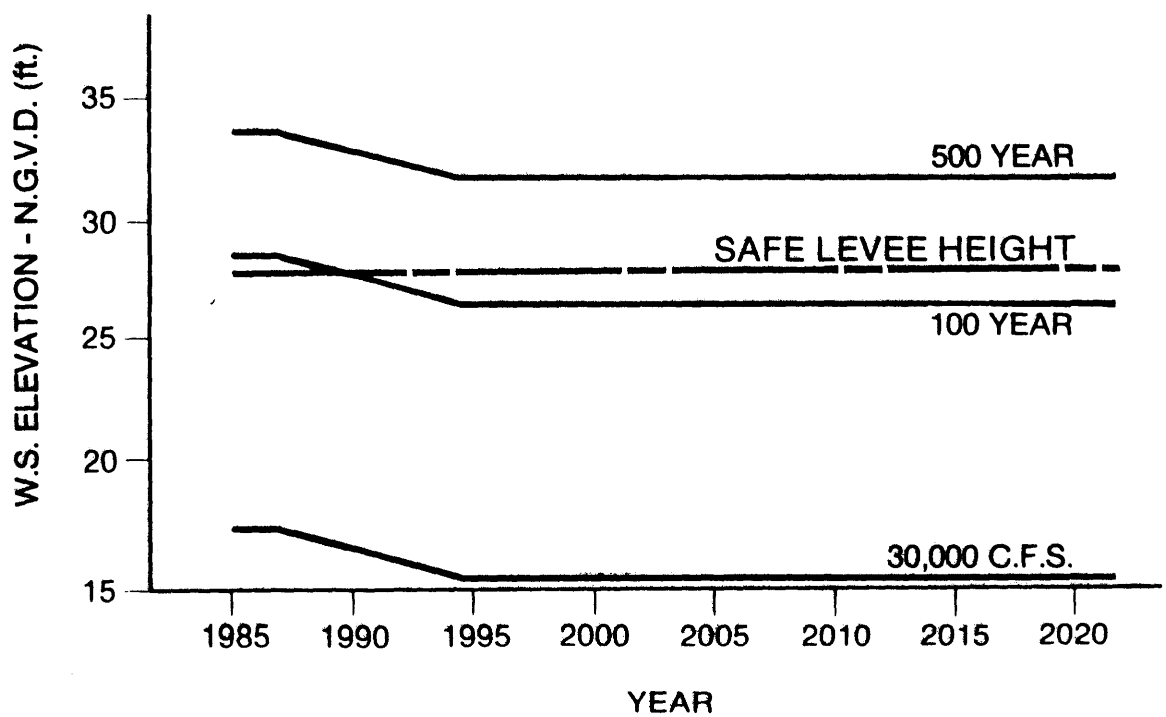


Figure IV-4. Water surface elevation for NED plan at Longview-Kelso (RM 5.5).

Table IV-4 summarizes the benefits and costs of all the alternatives evaluated. It demonstrates that the SRS at Green River meets the maximum net benefits criteria of the NED plan. It exhibits the highest benefit-to-cost ratio of all the solutions considered.

Table IV-4

Net Average Annual NED Benefits

($ 000,000)

	Base Condition		With-Project Condition				
Site/Height	Columbia Dredging Costs[1]	Cowlitz/ Toutle Dredging Costs[1]	Reduction in Avg. Annual Residual Damages[2]	Total Annual Benefits	Total Average Annual Costs	Net Benefits	Benefit-to-Cost Ratio
LT-3							
107	$5.6	$17.7	$0.0	$23.3	$26.7	$-3.4	0.87
132	5.6	17.7	4.5	27.8	27.8	0.0	1.00
162	5.6	17.7	4.5	27.8	34.0	-6.2	0.82
KID VALLEY							
118	$5.6	$17.7	$0.0	$23.3	$23.5	$-0.2	0.99
163	5.6	17.7	4.5	27.8	21.8	6.0	1.28
208	5.6	17.7	4.5	27.8	20.8	7.0	1.34
243	5.6	17.7	4.5	27.8	22.2	5.6	1.25
318	5.6	17.7	4.5	27.8	26.2	1.6	1.05
GREEN RIVER							
77	$5.6	$17.7	$0.0	$23.3	$23.9	$-0.6	0.97
112	5.6	17.7	4.5	27.8	20.3	7.5	1.37
142	5.6	17.7	4.5	27.8	18.0	9.8	1.54
177	5.6	17.7	4.5	27.8	17.9	9.9	1.55
202	5.6	17.7	4.5	27.8	20.0	7.8	1.39
272	5.6	17.7	4.5	27.8	25.8	2.0	1.08

1. These costs would be foregone with construction of a single retention structure. Dredging costs which will be required in addition to a single retention structure are included in the total annual with-project costs.

2. The average annual residual flood damages with the base condition are $7.1 million. With the larger SRS alternatives, the residual average annual damages are reduced to $2.6 million; the difference of $4.5 million represents flood control benefits attainable by the SRS.

SENSITIVITY OF NED PLAN TO VARIATIONS IN SEDIMENT BUDGETS

General

In this report, a level of uncertainty exists in projecting future conditions. This section examines the most critical future projection in the Feasibility Report, the sediment budget, testing each alternative against variations in sediment projections.

Methodology

Appendixes C and D present the details of the estimated sediment budget (hereafter depicted as E) of 650 mcy for the next 50 years. For comparative purposes, this sensitivity analysis looks at two other sediment projections that represent one-half the sediment budget (1/2 E) and 1-1/2 the sediment budget (1-1/2 E). The Corps' current estimate of future sediment is the E sediment budget, since it has the highest probability of occurring. The detailed backup for this sensitivity analysis is provided in appendix E.

This section examines the consequences for a chosen alternative when assuming one budget and a different one actually occurs. The section describes the residual average annual flood damages and cost of continued dredging on the Toutle, Cowlitz, and Columbia Rivers to maintain the base condition; and the costs of the SRS at Green River under the three different sediment estimates of 1/2 E, E, and 1-1/2 E.

Flood Damage Description for Various Storm Events

The following discussion describes the type and magnitude of flood damages for the three different sediment budgets, occurring during flood events of various frequencies. The varying levels of damage have been integrated with their respective frequency of occurrence to develop the average annual flood damage estimates. Total flood damages are indicated for various storm events and sediment budgets in table IV-5. The scenarios described below represent the

single occurrence of a flood event and its impact, given the base condition of the existing river channel. Damages result from the failure of levees when water surface elevations (river stages) exceed the safe height of each levee system. Although flood damages for three different sediment budgets are described below, the anticipated budget (E) is the only budget supported by extensive modeling and research.

Table IV-5
Total Flood Damages
($000)

Sediment Budget	Storm Event 10-Year	20-Year	50-Year	100-Year
1/2 E	$ 3,667	$ 4,310	$121,012	$161,350
E	4,121	35,580	154,649	177,700
1-1/2 E	35,015	121,442	163,800	202,675

One-half Budget. Damages for the following events would be incurred given one-half the anticipated budget.

a. Ten-Year Event. The ten-year event flood levels would not exceed safe height at any of the four leveed areas (Longview, Kelso, Lexington, and Castle Rock). Transportation facilities (major highways and bridges) would not suffer damages. Flood losses in the unleveed areas of the flood plain would arise mostly from farms, residential improvements, and Castle Rock High School. Total estimated flood damages for a 10-year flood event are $3,667,000.

b. Twenty-Year Event. The 20-year event flood levels do not exceed safe levee height at any of the four leveed areas and do not damage major transportation facilities. Flood damages to the unleveed areas of the flood plain, mostly farms and residential improvements, would amount to $4,310,000, including damages to Castle Rock High School. Total estimated flood damages for the 20-year flood event are $4,310,000.

c. Fifty-Year Event. With one-half the sediment delivery, the 50-year event flood levels exceed the safe heights of levees at Kelso and Castle Rock. Estimated flood damages at Kelso would be $85,000,000, including those to residential improvements, a major portion of the city's commercial district, and the entire industrial park. Castle Rock would incur $31,000,000 in flood damages, and the unleveed areas of the flood plain would experience $5,010,000 in damages. Major highway and railroad bridges near the Toutle River mouth would incur flood damages of $2,000. Levee safe height at Longview and Lexington would not be exceeded. Total estimated flood damages for the 50-year event with a one-half budget are $121,012,000.

d. One Hundred-Year Event. The 100-year event would exceed the safe height of all existing levees except Longview. Kelso would experience $88,000,000 in damages. Lexington would incur $35,000,000 in damages, and Castle Rock, $32,200,000. Unleveed flood plain lands would have damages of $5,980,000, and highways, railroads, and bridges comprising the transportation corridor would experience estimated flood damages of $170,000. Total estimated flood damages resulting from a 100-year event are $161,350,000.

Estimated Budget. Damages for the following events would be incurred under the anticipated sediment volume.

a. Ten-Year Event. The ten-year event flood levels do not exceed safe height at any of the four leveed areas (Longview, Kelso, Lexington, and Castle Rock). Flood damages in the unleveed areas of the flood plain would affect mostly farms, residential improvements, and Castle Rock High School. The transportation corridor is not affected by the 10-year event. Total estimated flood damages for a 10-year flood event are $4,121,000.

b. Twenty-Year Event. The 20-year event flood levels do not exceed safe levee height at Longview, Kelso, or Lexington, and do not damage major transportation facilities. The Castle Rock levee safe height is exceeded, and estimated damages of $30,800,000 would occur. The major portion of this city would be inundated, flooding residential and commercial properties. Castle Rock has no industrial area. Flood damages to the unleveed areas in the flood plain, mostly farms and residential improvements, would amount to $4,780,000,

including damage to Castle Rock High School. Total estimated flood damages for the 20-year flood event are $35,580,000.

c. Fifty-Year Event. The 50-year event flood levels exceed the safe heights of levees at Kelso, Lexington, and Castle Rock. Estimated flood damages at Kelso would be $86,200,000, including residential improvements, a major portion of the city's commercial district, and the entire industrial park. Damages at Lexington, amounting to $30,800,000, mostly concern residential properties but include a large BPA electric substation. Castle Rock would experience $32,000,000 in damages, an increase of less than 4 percent from the 20-year event. The unleveed area in the flood plain would experience $5,640,000 in damages, an increase of about 18 percent over those of the 20-year event. Major highway and railroad bridges near the Toutle River mouth would incur flood damages of $9,000. The levee safe height at Longview would not be exceeded. Total estimated flood damages for the 50-year event are $154,649,000.

d. One Hundred-Year Event. The 100-year event would exceed the safe height of all existing levees. Longview would experience an estimated $9,400,000 in flood damages. This amount is relatively small (less than 0.5 percent) compared to the damage potential ($1.3 billion) of this city. The damages would occur mostly to residential and suburban-type commercial enterprises located at low elevations within the Longview Diking District. Kelso would have $89,700,000 in damages, an increase of about 4 percent from the 50-year event. Lexington would undergo $37,500,000 in damages, an increase of about 22 percent beyond the 50-year event. Castle Rock would incur about $33,000,000, an increase of about 4 percent over the 50-year event. Unleveed flood plain lands would receive damages of $6,970,000, an increase of about 23 percent; while highways, railroads, and bridges comprising the transportation corridor would experience estimated flood damages of $1,200,000, an increase of 133 percent from 50-year flood levels. Total estimated flood damages resulting from a 100-year event are $177,700,000.

One and One-half Budget. Damages for the following events would be incurred in the event that sediment volume delivered was 50 percent greater than the amount anticipated.

a. Ten-Year Event. The ten-year event flood levels do not exceed safe height at three leveed areas: Longview, Kelso, and Lexington. The levee safe height at Castle Rock is exceeded and estimated flood damages of $30,500,000 would occur. Inundation of leveed areas of the flood plain will damage residential improvements and farms in these areas, including the high school at Castle Rock. The transportation corridor is not affected by the 10-year event. Total estimated flood damages for a ten-year flood event are $35,015,000.

b. Twenty-Year Event. The 20-year event flood levels do not exceed safe levee heights at Longview and Lexington and would cause only minor damage to transportation facilities. The safe heights of Kelso and Castle Rock levees are exceeded, resulting in $84,000,000 and $32,000,000 damages, respectively, to those communities. Major portions of these cities would be inundated, causing damage to residential and commercial properties. Damages to unleveed areas would amount to $5,442,000. Total estimated flood damages for a 20-year flood event would be $121,442,000.

c. Fifty-Year Event. The 50-year event flood levels exceed the safe heights of levees at Kelso, Lexington, and Castle Rock. Estimated flood damages at Kelso would be $88,000,000, including residential improvements, a major portion of the city's commercial district, and the entire industrial park. Damages at Lexington, amounting to $33,000,000, mostly concern residential properties but include a large BPA electric substation. Castle Rock would experience $33,000,000 in damages. The unleveed area of the flood plain would experience $9,740,000 in damages. Major highway and railroad bridges near the Toutle River mouth would incur flood damages of $60,000. Levee safe height at Longview would not be exceeded. Total estimated flood damages for the 50-year event are $163,800,000.

d. One Hundred-Year Event. With a 50 percent greater sediment budget than planned, a 100-year event would exceed the safe height of all existing levees. Longview would experience an estimated $12,500,000 in flood damages. This amount is relatively small (less than 1 percent) compared to the damage potential ($1.3 billion) of this city. The damages would occur mostly to residential and suburban-type commercial enterprises located at low elevations

within the Longview Diking District. Kelso would have $91,000,000 in damages, Lexington would incur $41,000,000 in damages, and Castle Rock would receive about $34,000,000. Unleveed flood plain lands would undergo damages of $10,175,000; and highways, railroads, and bridges comprising the transportation corridor would experience estimated flood damages of $14,000,000. Total estimated flood damages resulting from a 100-year event are $202,675,000.

Summary. While the flood damages from using the 1/2 E budget are lower than those from the E budget, significant damages still occur. The flood damages for 50- and 100-year events with the 1/2 E budget are close to those anticipated for E. In addition, if temporary evacuation of residents in the Cowlitz River flood plain were required, the cost would be $26 million.

Maintenance of the existing temporary structures will provide some benefits. Half of the freeboard can be used to reduce the base condition's residual average annual damages. However, this results in less than a 10 percent reduction. For the temporary structures to be rebuilt to their original condition, some of the existing temporary structures would need removal at a cost of $614,000 and complete replacement at a cost of $2.1 million.

Costs and Residual Flood Damages of Continued Dredging

Continued dredging to maintain the base condition represents a flexible method for dealing with different sediment levels as initial fixed costs are held to a minimum. As different levels of sediment migrate through the river system, they are dealt with to the extent practicable. The average annual cost (AAC) of the dredging alternative for 1/2 E are $8.0 million, for E the AAC are $23.3 million, and for 1-1/2 E the AAC are $46.9 million.

The different levels of sediment deposition in the Cowlitz River associated with 1/2 E and 1-1/2 E will result in different residual average annual flood damages (AAD) than those shown in appendix E. The dredging alternative will maintain a greater level of flood protection when less sediment enters the Cowlitz. The AAD for the dredging alternative with 1/2 E are $3.6 million, with E the damages are $7.1 million, and with 1-1/2 E they are $9.8 million.

Costs and Residual Flood Damages for Green River SRS

The costs for a Green River SRS and the associated downstream measures vary with projected sediment budgets. Assuming a budget of E, the SRS with the highest net benefits would be at Green River with a height of 177 feet. If the 177-foot SRS is constructed, variation in downstream costs will occur with different sediment budgets. The average annual costs of the 177-foot SRS plan and downstream measures for 1/2 E are $13.3 million, for E the AAC are $17.9 million, and at 1-1/2 E, AAC are $27.8 million.

If, however, a budget different from E is projected to occur, then the best SRS plan would be at a different height than 177 feet. For example, if 1/2 E is expected, the plan with the highest net benefits would be an SRS at Green River of 112 feet, while an SRS at Green River of 202 feet would be the best plan with an expected budget of 1-1/2 E. Here again the total plan costs will vary with different actual budgets because of downstream action costs. The table below summarizes the different AAC of SRS alternative with the different sediment budgets.

Table IV-6
Average Annual Costs
($ 000,000)

Actual Budgets	Green River SRS 112 feet		Green River SRS 177 feet		Green River SRS 202 feet	
	Structure	D/S Actions	Structure	D/S Actions	Structure	D/S Actions
With 1/2 E	8.0	3.3	11.2	2.1	13.4	2.0
With E	8.0	12.3	11.2	6.7	13.4	6.6
With 1-1/2 E	8.0	31.0	11.2	16.6	13.4	11.0

The residual average annual damages with the SRS are $2.4 million for 1/2 E, $2.6 million with E. With the 1-1/2 E budget, the AAD are $8.7, $7.0, and $4.7 million for the three different sized SRS's. The variation in AAD stems from how fast the structure fills in with sediment.

Comparison of Dredging and SRS

Table IV-7 presents the results of the sensitivity analysis. This matrix shows the nine possible combinations of structure design for one of three sediment budgets (1/2 E, E, 1-1/2 E) and the resulting costs and damages of actually incurring one of the three budgets. As stated above, if different budgets are expected, a different height of the Green River SRS would be required. That is, if more sediment were expected, a higher dam would be built. Each block in table IV-7 compares the total AAC and residual average annual flood damages (AAD) for the dredging and Green River SRS alternatives. The center block of this matrix represents the most likely future condition used for evaluation in this feasibility report. By comparing the sum of AAC and AAD in each block, one can identify the total cost to the economy and the least costly alternative under each scenario.

Table IV-7

Sensitivity Matrix

ACTUAL BUDGET			DESIGN FOR: SRS @ 112 ft 1/2 E	DESIGN FOR: SRS @ 177 ft E	DESIGN FOR: SRS @ 202 ft 1-1/2 E
1/2 E	SRS	AAC	11.3	13.3	15.4
		AAD	2.4	2.4	2.4
			13.7	15.7	17.8
	D	AAC	8.0	8.0	8.0
		AAD	3.6	3.6	3.6
			11.6	11.6	11.6
E	SRS	AAC	20.3	17.9	20.0
		AAD	2.6	2.6	2.6
			22.9	20.5	22.6
	D	AAC	23.3	23.3	23.3
		AAD	7.1	7.1	7.1
			30.4	30.4	30.4
1-1/2 E	SRS	AAC	39.0	27.8	24.4
		AAD	8.7	7.0	4.7
			47.7	34.8	29.1
	D	AAC	46.9	46.9	46.9
		AAD	9.8	9.8	9.8
			56.7	56.7	56.7

In all cases, if the 1/2 E budget actually occurs, then the dredging alternative represents the least cost plan. Alternatively, if E or 1-1/2 E budgets actually occur, the Green River SRS alternative is less costly than dredging for the three different sized SRS.

Another approach to the sensitivity examines the consequences of committing to an alternative based on an expected budget and then incurring a different budget. Since the best estimate of sediment movement is E, the following discussion examines the consequences of designing for this budget.

If the SRS of 177 feet is constructed in anticipation of the E budget and the 1/2 E budget occurs instead, the sum of AAC and AAD for dredging would be $11.6 million or $4.1 million less than the SRS costs and damages of $15.7 million. However, if the E budget actually occurs, then the 177-foot SRS plan would represent a cost and damage saving of $9.9 million ($30.4 - $20.5 million) over dredging. Finally, if the 177-foot SRS is constructed and the 1-1/2 E budget occurs, then the SRS would have a cost and damage advantage of $21.9 million ($56.7 million - $34.8 million) over the dredging alternative.

The breakeven point for the percentage of the sediment budget that would have to occur to produce the same costs for dredging and SRS is shown on figures IV-5 through IV-7 for each design scenario. Figure IV-6 shows that if the 177-foot SRS were built, it would have less costs and damages than dredging as long as 0.65 E, or volume in excess of 0.65 E occurs.

Conclusion of the Sediment Budget Sensitivity Analysis

If the NED plan discussed in this report were built in anticipation of the E budget, and 1/2 E actually occurs, then the least costly alternative was not chosen. However, if the NED plan were built and 0.65 E, or something greater actually occurs, then the NED plan represents a less costly alternative than long-term dredging.

Risk Analysis - Extreme Events

General. The first component of the sensitivity analysis demonstrated the relative advantages of the Green River SRS and continued dredging alternatives for different levels of sediment movement. The sensitivity analysis concentrated upon each plan's effectiveness in dealing with projected average annual movement of sediment. As explained in appendix C, movement of sediment over time is expected to vary widely from the average annual condition. The remainder of this sensitivity section describes

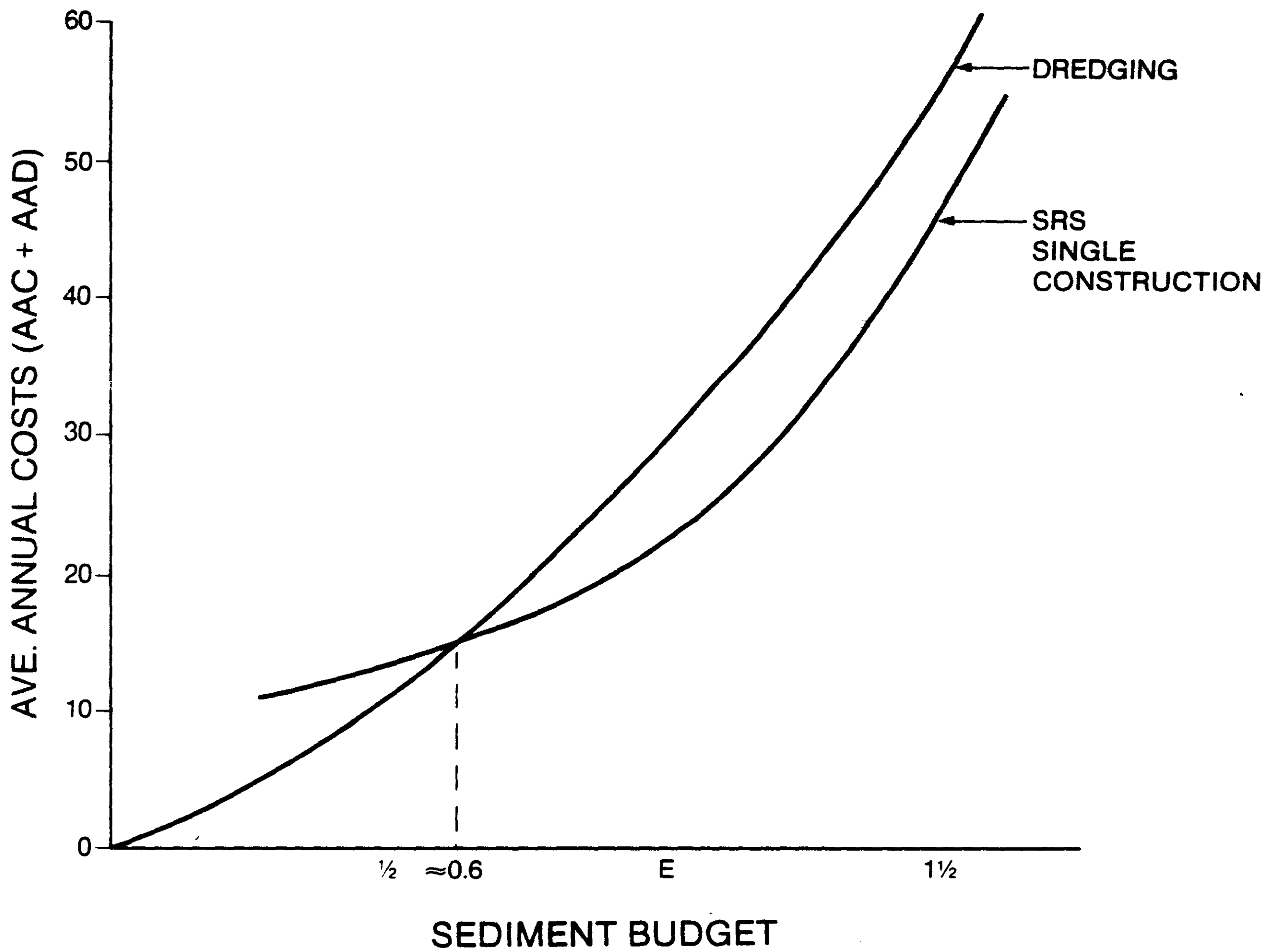


Figure IV-5. Structures Designed for ½E

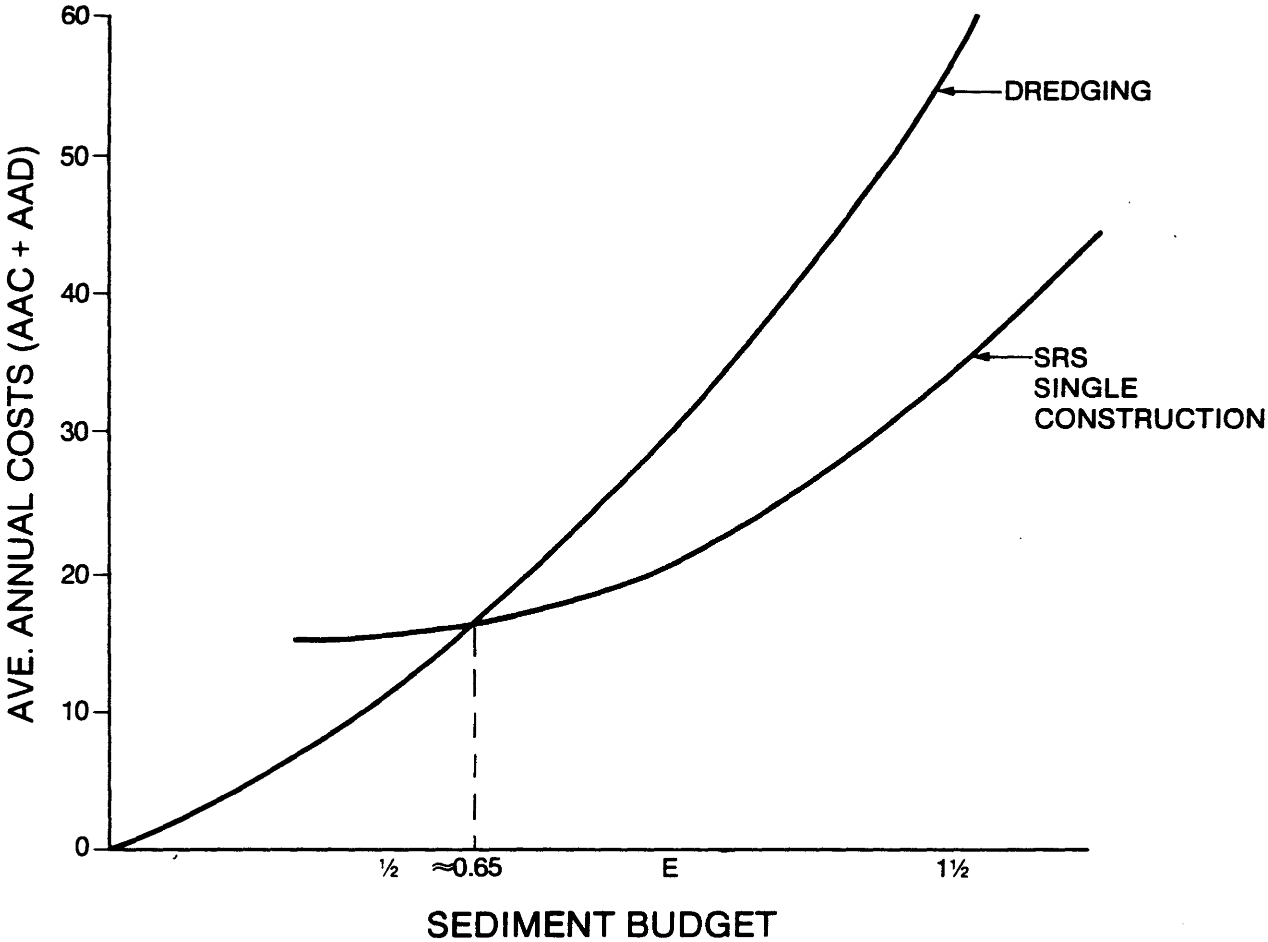


Figure IV-6. Structures Designed for E

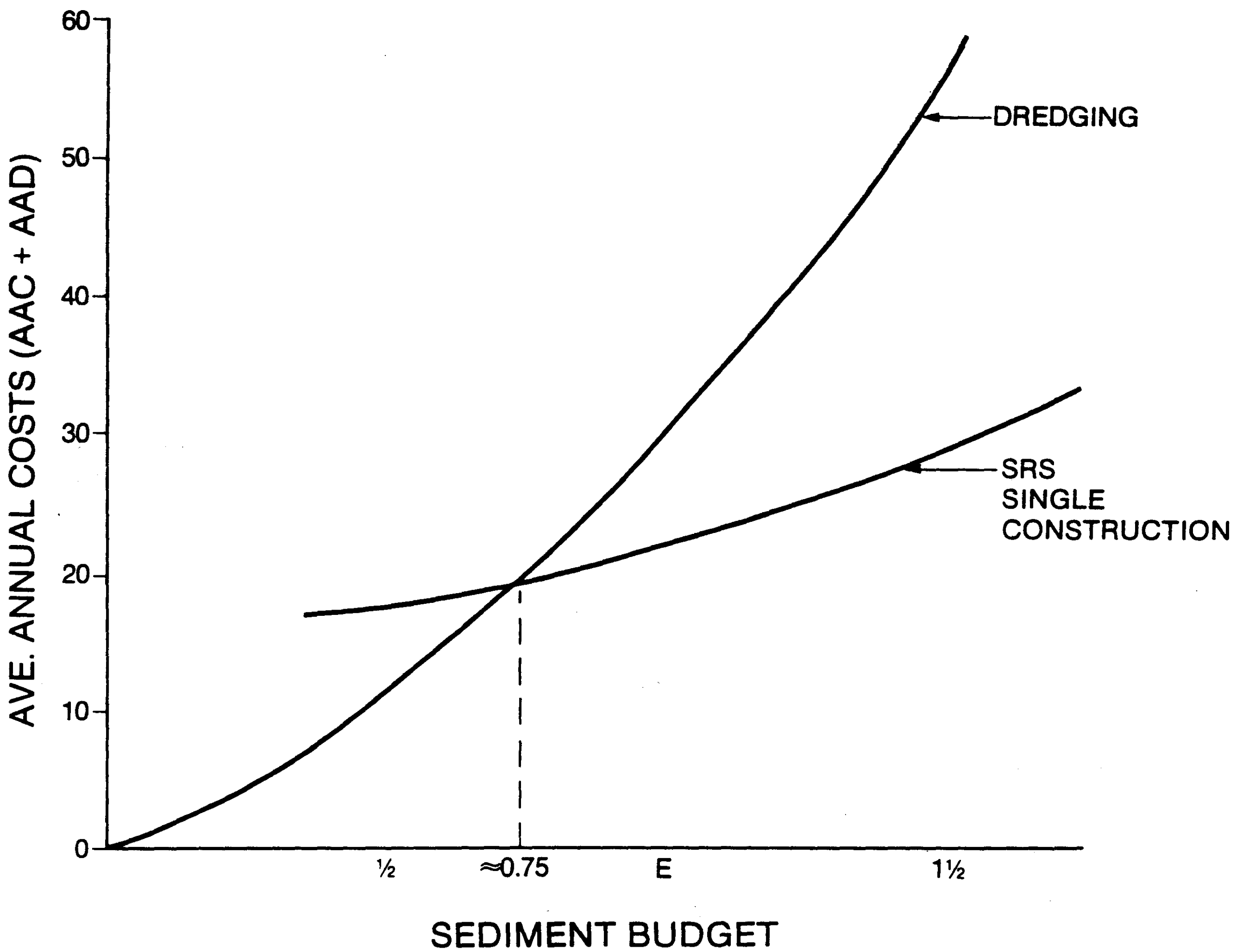


Figure IV-7. Structures Designed for 1½E

the risks associated with each alternative's ability to handle events generating greater than average sediment movements. Since it is impossible to predict the exact timing of non-typical hydrologic events and mudflows, they are not included in the evaluation process. This section demonstrates that the selection of the NED plan is sensitive to extreme sediment transport events and their associated risks of increased flood damages and navigation interruptions. The selection of the best plan must consider the risks associated with large sediment movement events.

Methodology. Two large sediment generating events are discussed below, mudflows and infrequent storm events. Mudflows are generated in two ways: (1) the failure of impoundments holding large volumes of water, and (2) volcanic eruption of hot gasses that result in rapid snowmelt. Since the impoundments containing lakes on the debris avalanche are no longer in danger of failing, volcanic eruptions would be the primary cause of mudflows in the future.

Rare frequency storms are typically caused in the Toutle Basin by large accumulations of snow, followed by rapid increase in temperatures and heavy rainfall which results in large floodflows. See appendix D for descriptions of these events.

Because of the large supply of material available in the debris avalanche, the magnitude of sediment movement for the mudflow and 100-year events remains constant over the 50-year period of analysis. Also, the sediment magnitude of each event is the same under the 1/2 E, E, and 1-1/2 E budgets. As discussed in appendix D, the mudflow event evaluated here is 75 mcy in the upper North Fork of the Toutle River. It is estimated that this event would deposit 14 mcy of sand in the Cowlitz River and 6 mcy in the Columbia navigation channel. Under the no-action condition, the 100-year flood event will deposit 3.6 mcy in the Cowlitz River and 6.7 mcy in the Columbia navigation channel. The risks associated with these two extreme events are evaluated below for both the base condition (dredging) and SRS using different sediment budgets.

Base Condition (Continued Dredging). The dredging alternative constitutes a reactive plan, since it removes sediment that has settled in the Cowlitz,

Toutle, and Columbia Rivers. Consequently, this alternative incurs the highest risks associated with both the mudflow and the 100-year flood events. The sediment quantities discussed above would require removal to maintain the base condition levels of protection and navigation channel depths.

The timing of mudflows and 100-year events is critical to the assessment of risks. For example, if the mudflow event occurred in the late fall to spring, the Cowlitz River could not be dredged in time to restore channel conditions for the remaining flood season. The added deposition at this time would substantially increase the flood risk. For example, if 14 mcy from the mudflow could not be dredged before the flood season, flood elevations would increase. Correspondingly, protection levels would drop drastically and average annual damages for that flood season would increase from $7.1 million (base condition) to in excess of $80 million.

Similarly, in the Toutle basin it is likely that under the base condition the 100-year flood event would occur early in the winter and deposit 5.2 mcy in the Cowlitz River, increasing flood risks throughout the remainder of the flood season. This would increase average annual flood damages from $7.1 million to $13 million. If these large events happen at the end of the flood season or through the summer, then the increase in flood risks are minimal, provided the material is removed prior to the following winter. However, the risks associated with interruptions to navigation in the Columbia River caused by the 5.1 mcy deposition remain essentially the same throughout the year.

The costs of removing this material would increase over time as the least expensive disposal sites are filled in. Using a weighted average of the per-unit dredging costs over the next 50 years, the expense of dredging materials from the mudflow and 100-year flood to restore the base condition are shown below.

Table IV-8
Dredging Costs with Mudflow and 100-Year Event[1]

	Columbia mcy	Columbia cost	Cowlitz mcy	Cowlitz cost	Total Costs
Mudflow	6	$18,600,000	14	$49,000,000	$67,000,000
100-year Event	5.1	$15,800,000	5.2	$18,200,000	$34,000,000

1. Computed as the weighted average of dredging costs in the base condition.

The years in which the mudflows and 100-year event would occur are impossible to predict. Based on historic records, however, volcanic activity is more likely to occur early in the 50-year evaluation period than later. Also, a 40 percent risk exists of a flood exceeding the 100-year flood within the next 50 years. Similarly, the risk of a flood exceeding the 50-year frequency flood in the next 50 years is 64 percent.

SRS Alternative. The effectiveness of the SRS alternative in storing sediment of mudflows and low frequency floods depends upon the size of the structure and the available reservoir storage. The higher the structure, the greater availability of storage over a longer time frame. Table IV-9 shows how long each of the four different-sized SRS alternatives would have adequate storage capacity to accommodate the entire 75-mcy mudflow and/or the 100-year flood event. This table assumes average annual sediment movement up to the dates shown.

Table IV-9

Years in Which SRS Alternatives Are No Longer Effective in Storing Mudflows and 100-Year Events[1]

	77-foot		112-foot		177-foot		202-foot	
	Mudflow	100-Yr	Mudflow	100-Yr	Mudflow	100-Yr	Mudflow	100-Yr
1/2 E	1987	1987	1988+	1988+	1993	2002	2004	2022
E	1987	1987	1988+	1988+	1991	1995	1994	1999
1-1/2 E	1987	1987	1988+	1988+	1989	1991	1991	1994

1. Assumes that average annual inflow of sediment occurs up to this date and the mudflows or 100-year events occur in the years shown.

Figure IV-8 graphically presents the 100-year flood event. As the plot of the 1/2 E budget shows, for every 10 feet of structure height beyond 177 feet, the capacity to handle the 100-year flood is extended an additional 8 years. In contrast, for every 10 feet of dam height up to 112 feet, less than 1 year of effectiveness is added. The slope of the lines in figure IV-8 define the marginal reduction in risks associated with the rare events due to changes in structure heights.

These curves demonstrate that with the 1/2 E budget, structures in excess of 142 feet are the most efficient for dealing with rare events. Although relative advantages are not as well defined for the E and 1-1/2 E budgets, it appears that structure heights in excess of 160 feet (for E) and 190 feet (for 1-1/2 E) are more efficient for handling the 100-year flood event. These same general conclusions hold for the mudflow event.

The risk of flooding and navigation interruption associated with the mudflow and 100-year event are nil up to the time described in table IV-9. After these effective dates, the SRS will lose its capacity to trap the entire sediment movement; and flooding risks will eventually increase to the levels of the dredging alternative. Each structure will, however, be able to partially

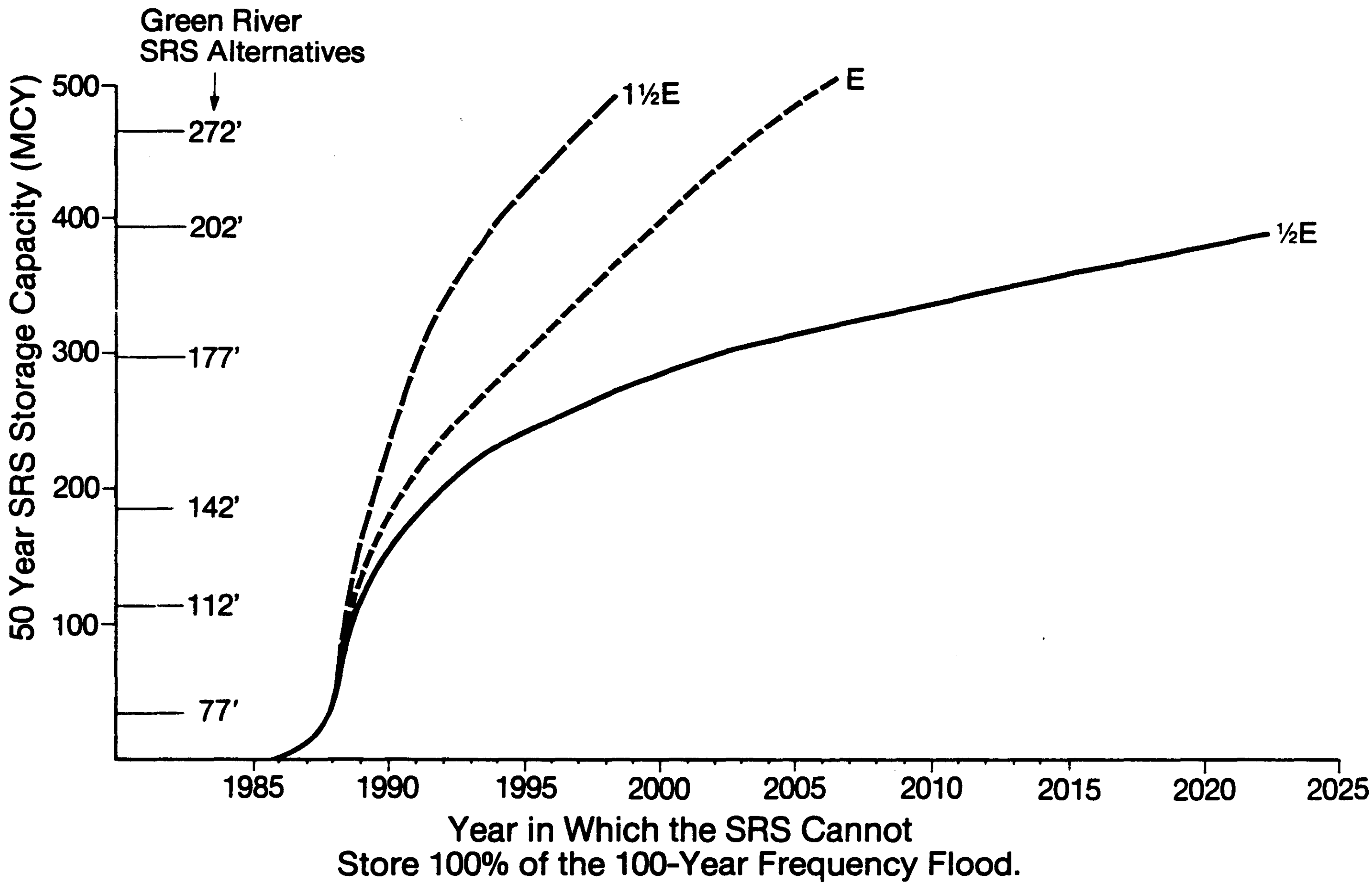


Figure IV-8. 100-Year Flood Event

reduce sediment movements after the dates shown in table IV-9. One other inherent advantage of the SRS alternative over the base condition is that during the years in which the SRS is efficiently storing material, the Cowlitz River streamflow will act to scour out sediments. This will increase channel capacity and produce a higher level of protection in the Cowlitz. Therefore, when the SRS is no longer able to contain the mudflow or a large flood event, any subsequent deposition in the Cowlitz River would result in a smaller increase in average annual damages than provided by the dredging alternative. Furthermore, with the SRS, the amount of dredging in the Cowlitz, Toutle, and Columbia Rivers is much smaller than with the base condition; and the less expensive dredge disposal sites are not exhausted as rapidly. As such, the per-unit costs for required dredging after a mudflow or 100-year flood would be less with the SRS alternative than under the base condition.

Summary of Dredging and SRS Comparison. The SRS alternatives substantially reduce risks of increased flood damages and navigation interruptions due to large mudflow events and rare frequency floods. The size of the structure determines how many years the SRS will be able to store these large events. For example, with the estimated budget (E) the 77-foot-high SRS will be able to completely accommodate the 100-year event only until 1987, while the 202-foot-high SRS will be effective until 1999. If the large events occur within the SRS effective time frames, downstream impacts are significantly reduced by the structure and a substantial reduction in risks is realized, compared to the dredging alternative.

With the dredging alternative, a design mudflow event would cause substantial flood damage and also clog the Cowlitz River channel. If this sediment deposition in the Cowlitz could not be removed before the flood season, the potential average annual damages (AAD) would increase by about $72.9 million. The costs of removing the sediment deposited by a mudflow event is $49 million in the Cowlitz and $18.6 million in the Columbia River. None of these costs will be incurred if the SRS has capacity to completely store the event. Similar findings occur with the 100-year event. Even when the storage capacity of the SRS alternative has been reduced to a level that cannot completely contain the large events, the SRS alternative would continue to provide advantages over the dredging alternative. These advantages include:
(1) partial containment of large event

sediments, (2) less average annual flood damages because of scouring in the Cowlitz River up to the date of the rare event, and (3) reduced per-unit dredging costs of both the Cowlitz and Columbia Rivers.

Sensitivity of Sizing of SRS to Handle Large Events. The ability of any SRS to handle a large influx of sediment from mudflows and rare floods diminishes over time as the structure fills with sediment. Figure IV-8 shows, for the range of sediment budgets, the years in which the different sized SRS lose their capacity to store the entire sediment amounts generated by a large event.

The slopes of the curves in figure IV-8 demonstrate the marginal changes in the ability to store mudflows and rare flood events based on SRS heights. The flatter portions of the curves represent the range of SRS heights in which each additional foot of structure substantially reduces the downstream risks from mudflows and the 100-year event.

If the 1/2 E budget occurs, any SRS higher than 142 feet provides definite advantages over the lower structures in terms of reducing risks associated with rare events. Consequently, if the projected budget were 1/2 E, selection of a preferred plan would be sensitive to accounting for the risks of mudflows or rare flood events. As stated earlier in this chapter, the best plan with a 1/2 E budget is 112 feet high. But, based on this risk analysis the preferred plan would be a project in excess of 142-foot height.

For the estimated budgets E and 1-1/2 E, selection of the preferred plan does not appear to be sensitive to the risks associated with rare events. That is, the changes in risks for deviating from the NED plan are minimal and do not warrant building a higher structure. With the estimated sediment budget (E) the NED plan is a 177-foot-high structure able to store the entire 100-year event up to year 1995. By constructing the next highest structure of 202 feet, 4 more years are added to the structure's ability to handle a 100-year event. Since it is impossible to determine when the 100-year flood or mudflow would occur, the economic value of 4 more years of protection could not be established. The incremental structure cost for a 177-foot to 202-foot structure raise is in excess of $30 million and is not warranted by the indeterminant reduction in risks.

Conclusion. For the estimated budget (E), the selection of a plan other than the NED plan is not sensitive to considerations of rare mudflow or flood events. If 1-1/2 E budget were expected, the 202-foot-high NED plan provides a reasonable degree of protection from rare flood events. However, if the 1/2 E budget were expected, the NED plan would be a 112-foot-high structure accommodating mudflows and 100-year events only until 1987. With 1/2 E, a 177-foot structure could accommodate a 100-year event until 2002. Consequently, the selection of a preferred plan may be sensitive to mudflows and rare flood events if the 1/2 E budget is expected.

CHAPTER V - THE PREFERRED PLAN

OVERVIEW

Chapters II through IV presented the formulation process used to develop the NED plan. This chapter discusses the factors considered in identifying the preferred plan, describes the elements of the plan, outlines anticipated direct and indirect benefits, and summarizes total costs and benefits.

The NED plan, a 177-foot structure at Green River, was selected because it is $117 million less than its nearest competitor, a 142-foot structure at the same location. The principles and guidelines used for Federal studies require designation of the NED plan as the preferred plan unless overwhelming evidence justifies another selection. This report examines factors beyond the benefits attributable to impacts on the average annual sediment projections.

The structure should contain either a design mudflow of 75 mcy or the sediment delivered by a 100-year event in the first years of the life of the project. Since the early years are the most susceptible to risks created by large sediment movement, no additional provisions are considered necessary for the project. As sediment deliveries decrease with time, significant risks created by large events are reduced. Should revised long-term projections indicate an increase in sediment delivery over projected quantities, provisions can be made to raise the structure.

As the discussion on the sensitivity of the NED plan notes, the 177-foot structure provides, during the first years of its life, enough capacity to contain either a design mudflow or the sediment delivered by a 100-year event. The 177-foot structure provides approximately 100 mcy more storage over its 50-year life than does the 142-foot structure. This additional storage allows the 177-foot structure to capture sediment from extreme events longer than the 142-foot structure and at a lower total cost.

The operation of the 177-foot structure was tested for both the 100-year flood and the design mudflow to compare to the with-project and without-project

conditions. Routing of the 100-year flood shows that conditions will not be worsened at either the structure site or at downstream damage centers. Construction of the structure will not worsen the effects of the design mudflow at the structure or immediately downstream. Effects of the structure on the mudflow peak and duration at downstream damage centers has not been fully evaluated.

During public and agency review of the Comprehensive Plan, Washington State, local governments and various resource agencies supported a single retention structure upstream of the Green River confluence with North Fork Toutle River. Reasons for the selection of this alternative included upstream sediment trapping and minimum impact to the fishery, land use and residents. The NED plan fulfills the desires of these important groups (see chapter VIII).

Briefly, the preferred plan consists of a single retention structure at the Green River site as shown on figure V-1, downstream dredging and some levee reinforcement. This plan fulfills the primary objectives of reducing flood hazards at communities along the lower Cowlitz River while reducing dredging requirements in the Columbia River navigation channel. In its combination of elements, the plan offers maximum flexibility to respond to changing conditions in the unstable Toutle River Basin environment caused by eruptions of Mount St. Helens. The plan also incorporates the recommendations of Cowlitz County's Toutle-Cowlitz Watershed Management Plan which advocates measures to block sediment upstream and recommends remedial actions to prevent flooding anticipated before implementation of long-term actions. The Corps' preferred plan would prevent sediment and debris from moving downstream, while the dredging would remove material already in the system or that moves through the Toutle River during construction of the SRS.

PREFERRED PLAN ELEMENTS

The Single Retention Structure

Description. The design and construction methods employed for this structure reflect normal dam design criteria and will address safety and operational

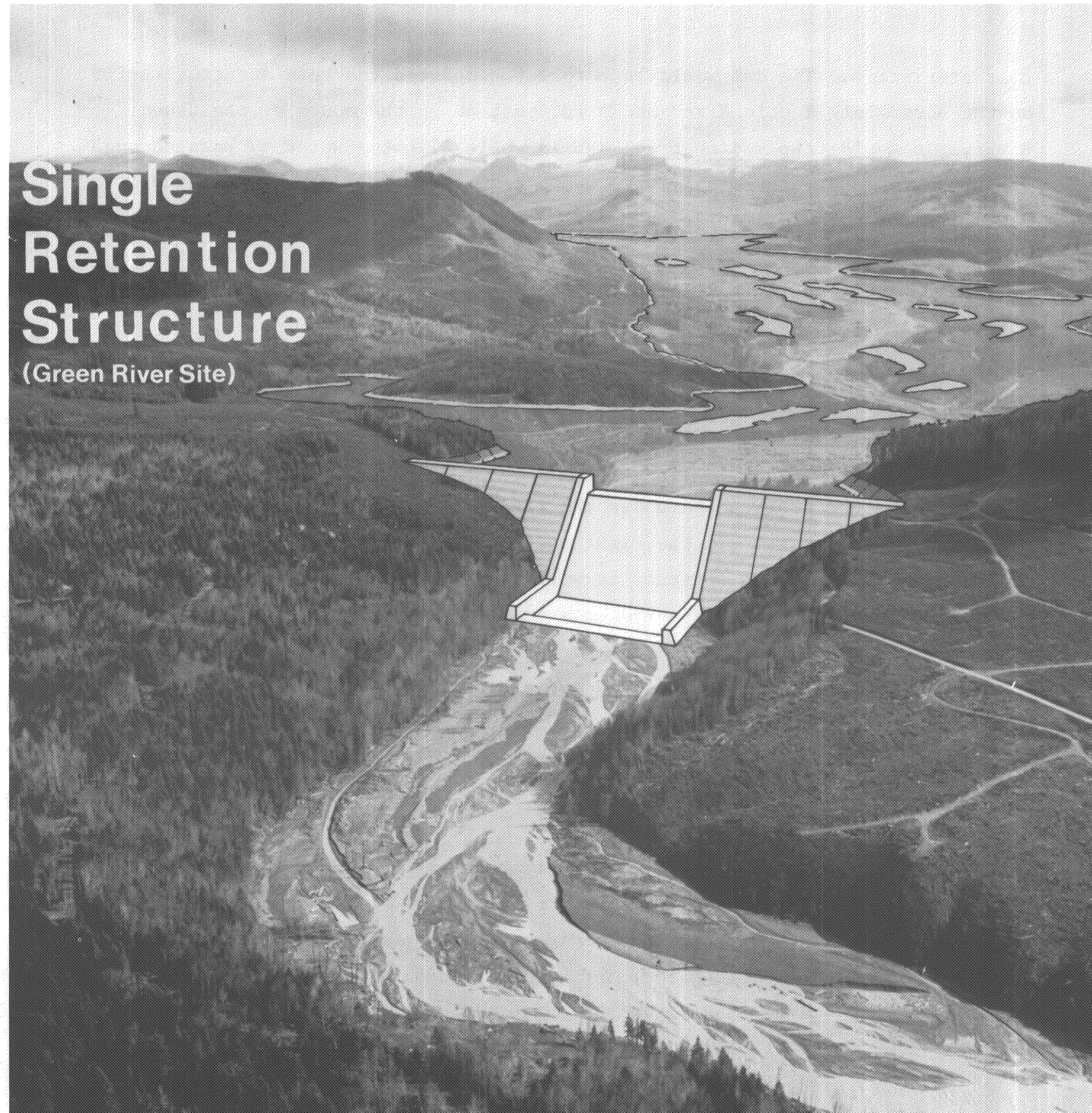


Figure V-1. SRS at Green River site.

characteristics. The dam would be a roller compacted concrete structure built on the North Fork Toutle River at RM 13, just above the mouth of the Green River. It would trap sediment and debris while allowing water to pass through an outlet works or over a spillway. When completed, the dam would rise 315 feet high above foundation grade or 177 feet above existing ground and extend 4,400 feet in length, with a spillway 600 feet wide. Ultimate sediment storage capacity would be 411 mcy, sufficient to retain the 299 mcy of material anticipated to deposit during the project life of 50 years.

Several alternative dam designs could achieve the desired end result. Final choice of design will be made during the detailed design phase.

The first feature constructed under the plan would be a large cofferdam upstream of the damsite and the right abutment outlet works. The cofferdam would serve two purposes. First, it would divert river flows around the work site; and secondly, it would serve as a small interim sediment retention structure. Retention of sediment behind the cofferdam at the earliest possible date will significantly reduce downstream actions. Once the main structure is constructed to a functional elevation higher than the cofferdam, the cofferdam will be abandoned in place in the impoundment area behind the main structure.

The main spillway would be built 155 feet above the existing streambed. Given normal hydrologic conditions, this height will create capacity adequate to capture nearly all problem-causing sediment debris anticipated to erode from the debris avalanche between 1987 and 2001. In addition, this structure provides enough storage and retention capability for sediment yielded during a 100-year flood until 1995. It has similar capability for a design mudflow until 1991. Using outlet works in the structure permits varying the size and depth of the pool extending upstream behind the structure to retain sediment produced during various storm events. During a major storm, a large pool would form, allowing more material to settle out prior to reaching the structure and outlet works.

The structure in its present design not only retains sediment but also provides limited flow control through a notched spillway or a regulating outlet.

However, flow control declines over time as the pool fills and is considered incidental to the structure with no benefits claimed.

Design of the Structure. Initial engineering activities would focus on design of the structure to trap sediment. Assuming receipt of design funds for fiscal year (FY) 1985, (October 1984 through September 1985), design work could be done during FY 1985 so that construction on the cofferdam and outlet works could be initiated in 1986 and completed in 1987.

a. Preliminary Design of the Structure. Preliminary analysis of the Green River site showed the foundation composed of competent basalt, indicating that it could provide adequate support for the proposed structure. Before carrying forward the design, some additional field surveys and explorations may be necessary. All studies required to satisfy Corps' design standards would be carried out.

A technical appendix summarizing preliminary engineering studies and design is included in appendix D.

b. Sizing of the Spillway. Under normal conditions, a spillway is sized to pass the probable maximum flood (PMF). However, given the instability of the upper Toutle River Basin and the necessity for providing the greatest possible margin of safety, the spillway for the retention structure would be sized to pass a sediment bulked PMF with 5 feet of freeboard during the project life.

The preliminary design assumes that Spirit Lake and other upper basin lakes are stabilized. Therefore, hypothetical lake breakouts have not been used as a basis for sizing the spillway. However, the structure would be designed to withstand overtopping in the event of some major event. This insures that even under these conditions the presence of the structure does not aggravate downstream conditions.

Table V-1 shows the peak discharges at the Green River site for normal annual flows, low frequency floods, and the probable maximum flood.

Table V-1
Peak Discharges For Normal and Possible Flows
At Green River SRS Location

Type of Flow	Peak Discharge (cfs)
Mean Daily Flow	1,254
10-Year Flood	13,900
50-Year Flood	17,700
100-Year Flood	19,600
500-Year Flood	23,700
Probable Maximum Flood (PMF)	107,000
Sediment Bulked PMF	176,000

As the table indicates, the peak discharge for the probable maximum flood is 107,000 cfs. Estimates of the peak discharge for the PMF were increased to include sediment entrainment of 65 percent, resulting in a peak discharge of 176,000 cfs.

As sediment infills behind the structure, detention time is decreased (ultimately a run of river configuration) and an additional height of dam crest may be required as an added safety margin. This would prevent outflanking and overtopping of the structure by the sediment such as occurred at debris retention structure N-1.

c. Stilling Basin. A stilling basin for dissipating the energy generated by the spillway discharges will be built as a feature of the dam. Designed to minimize downstream erosion, the basin will be founded on a layer of select fill placed over the foundation gravels and tied to bedrock with anchors. The physical size of the basin and details of materials and construction will be determined in the design phase of the project.

d. Sizing of the Dam. Over the 50-year project life, the dam eventually could retain 299 mcy of sediment (see appendix D). Initially this material would fan out in the upstream end of the pool behind the structure, eventually

migrating toward the dam. To determine the amount of sediment and the size of dam needed to retain it, required an estimate for the upstream slope of retained sediment. Based upon recommendations from the Corps Waterways Experiment Station staff and experience gained from monitoring DRS N-1, an upstream slope of one-half the natural river grade was used to develop the potential storage availability. A curve was then generated in order to plot sediment storage capacity for varying spillway heights. This curve showed that a structure built to retain 299 mcy of sediment would require a spillway 155 feet high.

Downstream Actions

The second element in the plan addresses the immediate problem of sediment now moving through the rivers. Some 20 mcy is estimated in the system, migrating downstream in waves. As the river scours at one site, that material deposits at other points along the river.

To trap sediment now in the system and anticipated to move through it during construction of the retention structure, downstream dredging would occur at two sites on the Toutle (LT-1 and LT-3). Material dredged from the river at these sites would be placed in disposal areas outside the 100-year flood plain. Of the sites considered, the Toutle locations offered a number of advantages. First, they have been identified as natural deposition areas; second, they were used successfully to excavate sediments during emergency actions following the 1980 eruptions; and third, with access roads already established, work could begin quickly. Finally, these locations have the greatest amount of potential disposal areas available nearby. This not only reduces the cost of dredging, but also minimizes impacts on the environment.

The downstream dredging contributes to the flexibility of the plan. The level of dredging activity can increase at a given location or cease altogether at another if the region experiences a short rainy season. However, dredging does have limited efficiency. Even with continual dredging at both sites, not all the material currently in the system can be trapped and removed. A large storm or two closely-spaced storms could transport more sediment than the basins hold. In addition, the dredging equipment has a limited capacity.

The basins would be operated to remove the majority of material flowing into the Cowlitz. Thus, if operations were begun in FY 85, 14 mcy of the sediment yield predicted in the sediment budget would need removal from the basins in order to prevent sediment from moving into the lower Cowlitz River. During FY 1987-1988, some sediment would be trapped by construction activities during the initial stage of the structure. Once the structure is in place, only minimal downstream dredging would be required because the Cowlitz and Columbia Rivers have the capacity to transport all of the material expected to erode below the structure.

The projected sediment budget will vary from year to year, depending on the severity and timing of storms. Operations at the sediment stabilization basins will be evaluated yearly. Some material could continue to pass into the Cowlitz, but the reduction in sand yield will increase the transport capacity of the Cowlitz River. Sediment accumulated in the riverbed would erode and move into the Columbia River where normal maintenance dredging operations would handle the material as needed.

Under the preferred plan, dredging requirements on the Columbia River would be reduced compared to the no-action condition. Dredging would be confined to the mouth of the Cowlitz River, and for several years the Corps will use available disposal sites along the Columbia River. Early costs will reflect the expensive inland disposal sites, while long-range costs will reflect ocean disposal.

Other Miscellaneous Actions

In addition to the single retention structure and downstream dredging, implementation of the plan may also require other minor actions to insure the continued effectiveness of the plan. Specific work locations have not been identified; however, work activities are expected to include localized reinforcement and repair of existing levees and placement of limited amounts of revetment to prevent excessive bank erosion or damage to existing structures.

Fish and Wildlife Measures

The project contains features to minimize impacts on fish and wildlife resources. The primary measure is a fish bypass facility at the single retention structure. While additional planning and engineering is necessary to determine the complete feasibility of such a facility, preliminary study indicates that passage can be provided. Conceptually, these facilities would consist of a trap and haul operation for adult migrants (adult migrants would be trapped at the foot of the structure and hauled in vehicles upstream of the dam for release), with juvenile passage occurring as part of water releases through the regulating outlet and spillway. The Federal government would pay the cost of construction and evaluation of these facilities, while operation and maintenance would be a State responsibility. The construction costs for these facilities are not separately broken out in table V-2 (Cost Summary). However, the trapping expense is included in the line item "Miscellaneous Works," while the hauling expense is contained in the total for "O&M Monitoring." Preliminary estimates indicate about $1,000,000 for construction and $75,000 for annual operation and maintenance.

To minimize wildlife impacts associated with the preferred plan, the Corps would manage the reservoir and disposal lands to provide wildlife habitat.

CONSTRUCTION

Preliminary Construction Requirements

Preparations for construction of the retention structure would require some rerouting of roads, clearing of land in the proposed impoundment area, and diverting the North Fork Toutle River. Currently, the State of Washington is studying the public need for State Highway 504, which parallels the North Fork Toutle River at the Green River site. Therefore, requirements for relocation of this highway have not been included in the project estimate (see chapter X for further discussion). Land behind the retention dam would be cleared of floatable debris to prevent debris from clogging the proposed outlet works. Finally, North Fork Toutle River would be diverted by means of a cofferdam and construction of the outlet works. Figure V-2 below presents the proposed construction schedule.

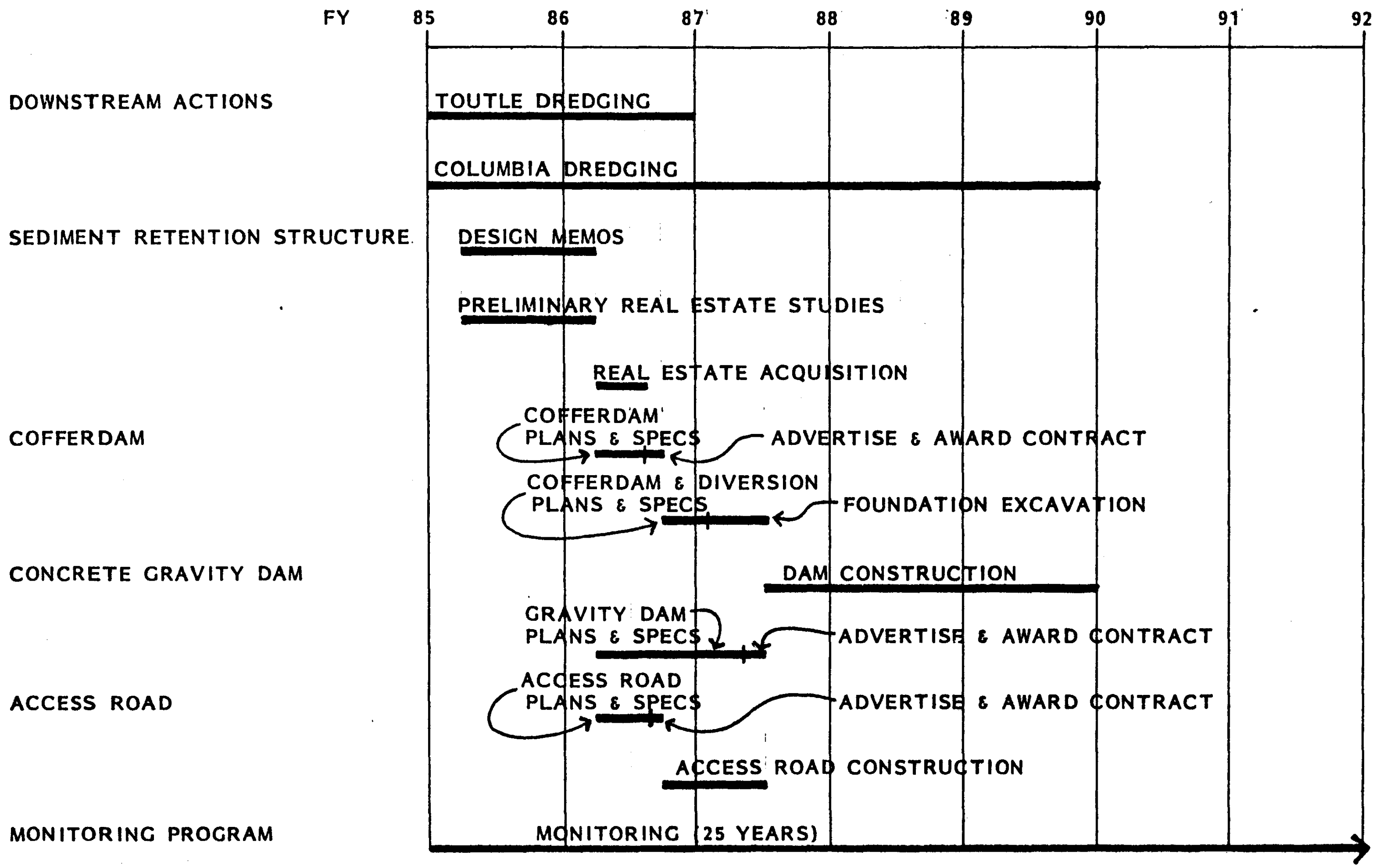


Figure V-2. Proposed Construction Schedule

Final Project Condition

In its final condition, the storage behind the structure will be completely full of sediment. At this point, the structure will not have any reserve capacity to regulate flows, mitigate mudflows, or retain sediment. The project will basically become a run-of-the-river project, allowing all inflow to pass on downstream.

MAINTENANCE AND MONITORING

Once in place, the single retention structure as a Federally operated project would require inspection on a regular basis and maintenance to correct problems affecting the operation of the structure. The inspection would comply with established dam safety inspection and evaluation regulations. Potential maintenance items include repairing damage to the surface of the spillway crest, face and stilling basin caused by sediment erosion and scour; refacing the surfaces of the regulating outlet conduit; removing floating debris and trash from the intake areas; replacing riprap downstream of the stilling basin; overhauling the fish trap facilities; cleaning out infill in the stilling basin and drain holes; adjusting or fixing monitoring equipment; repairing project access roads and structures damaged by mudflows and low frequency hydrologic events.

In addition to routine inspection and maintenance, the plan includes a continued monitoring program. Sediment moving into the upstream impoundment area and accumulating behind the structure would be surveyed to determine the size and scheduling of possible increments to the dam. Samples of flows passing over the spillway, especially those during storms would be analyzed to determine sediment load and turbidity levels. Finally, for the first two years of the project periodic cross-section surveys of the river would determine the level of dredging required at the sediment stabilization basins and throughout the river system. Annual operation and maintenance costs are estimated to be $500,000 for the life of the project.

Maintenance of disposal areas used for dredging on the Cowlitz and Toutle Rivers would consist of placement of limited amounts of revetment to prevent excessive bank erosion of the disposal sites as well as maintenance or reseeding of the required grass cover for those areas.

REAL ESTATE REQUIREMENTS

Single Retention Structure

The real estate requirement for the single retention structure basin covers approximately 7,470 acres. This includes land for the dam, appurtenant structures, impoundment area, and project access roads. The acquisition requirement for the structure would involve approximately 24 ownerships, of which 9 are occupied. These lands would be conveyed to the United States. As stated earlier, no real estate requirements have been included for the relocation of State Highway 504. Cost of road relocation is estimated to be $4.3 million.

Downstream Actions

a. Dredging Site 1 (LT-1) covers 385 acres which includes the riverbed and disposal areas. A local cooperative agreement was executed with the State of Washington on 3 January 1983. The State has indicated it will secure the remaining tracts needed for continued operation at this site.

b. Dredging Site-2 (LT-3) covers approximately 560 acres which includes the riverbed as well as the disposal areas. There are approximately 37 ownerships involved.

Miscellaneous downstream actions such as stabilizing streambanks of dredged disposal areas and possible other actions may have real estate requirements; however, the land requirements and acquisition have not been established at this time.

COSTS OF THE PREFERRED PLAN

The total cost of the plan is $292.2 million. Costs of the individual features are shown on table V-2.

Table V-2

Cost Summary

($000) 1984 dollars

SRD at Green River	
Mobilization/Diversion	$ 3,800
Reservoir Clearing	4,700
Concrete Dam	47,200
Outlet Works	11,400
Miscellaneous Works	3,000
Spillway	29,000
SUBTOTAL	$ 99,100
Contingencies	19,900
E&D and S&A	16,700
O&M/Monitoring	45,000
Real Estate	14,300
TOTAL	$195,000
Downstream Actions	
Cowlitz/Toutle Dredging	
Real Estate	$ 2,000
Sediment Removal	45,000
SUBTOTAL	$ 47,000
Contingencies	9,000
E&D and S&A	8,100
TOTAL	$ 64,100
Columbia River Dredging[1]	
Sediment Removal	$ 33,100
GRAND TOTAL	$292,200

[1] Although the sediment removal cost for Columbia River ($33.1 million) is part of total project costs, it would be funded under the existing authorization for maintaining the 40-foot navigation channel, Rivers and Harbors Act of 23 October, 1962.

BENEFITS OF THE PREFERRED PLAN

Benefits attributable to the preferred plan are the same as those discussed in the NED plan in chapter IV.

Economic and Social Effects

In communities along the lower 20 miles of the Cowlitz River, persistent uncertainty about risks of flooding and volcanic activity have had major social and economic effects. First, elaborate strategies have been developed for responding to potential disasters. Second, some residents in the area show symptoms of severe stress. Their concern is exacerbated by the knowledge that solutions are neither simple nor likely to be implemented without some delay. Some residents have chosen to leave the area. Third, because long-range planning is impossible, investment strategies have changed, delaying decisions on business relocation and expansion.

With a long-term permanent solution approved and implemented, reduced flood hazards would restore normal economic conditions and improve the climate for business and investment. Anxiety and uncertainty among residents would be reduced. Furthermore, the preferred plan would temporarily stimulate the local economy by providing jobs during construction. Partially offsetting the economic stimulus would be a reduction in potential future timber harvesting because of the requirements for the SRS impoundment area. Also, some land would be required for sediment basin disposal sites. However, no major alterations in land use or regional shifts in tax structure would result from the project; these findings (see appendix E) are in conformance with the Cowlitz County Development Plan. In sum, the preferred plan would strengthen the underlying economic base of Cowlitz County and enhance its quality of life.

Prevention of Erosion

In the aftermath of the 1980 eruptions, material dredged from the Cowlitz and Toutle Rivers during emergency actions was placed along the riverbanks. In response to the heavy increase in sediment load, the river channel has shifted radically at a number of points, eroding some disposal sites and adding to the sediment in the river. Once dredging and construction of the single retention structure is underway and the sediment load downstream is decreased, the river channel will stabilize and bank erosion will drop to pre-eruption levels.

Until then, miscellaneous preventive measures--riprap and revetment--would be instituted at threatened sites to stabilize erosion.

Maintenance of Water Quality

Under the preferred plan, water quality could degrade in the short term, but improve in the long term. Current levels of turbidity will persist, and possibly increase, during the two years of dredging at the sediment stabilization basins. However, when the retention structure is in place, the substantial reduction of sediment in the system will lower turbidity and particulate levels.

Protection of Fish and Wildlife

The effects of the preferred plan on fish and wildlife are briefly summarized here; these are further detailed in the Environmental Impact Statement (EIS) included with this report, as well as in the Fish and Wildlife Coordination Act Report, an exhibit to this report.

The placement of a single retention structure on the North Fork Toutle River above the confluence of the Green River would result in the following beneficial and adverse impacts. As sediment is trapped behind the dam, downstream riverbeds and channels would be stabilized and turbidity would be decreased. This would result in maintaining at least a migratory path to the upper Cowlitz River hatcheries, South Fork Toutle, and Green River systems. In addition, this channel stabilization will allow the quicker reestablishment of riparian vegetation. Fish passage facilities will mitigate the blockage to upstream migrants. The reduction of sediment below the structure would provide some spawning and rearing habitat in the main stem Toutle River. However, this benefit could be reduced by potential water quality problems resulting from impoundment. This problem would result from solar heating, raising downstream river temperatures during the summer and fall. The impact of solar heating could be minimized by controlling volumes of water impounded seasonally behind the dam. The sediment buildup behind the structure would adversely impact fish and wildlife, already harmed by the effects of the Mount

St. Helens eruption. To mitigate the loss of wildlife habitat above the structure, reservoir lands will be managed to preserve available habitat for as long as practicable and to include some revegetation at a minimum cost. This loss of wildlife habitat above the structure would be partially offset by the expedited recovery of riparian vegetation below the structure.

Downstream of the retention structure, sediment removal operations, except at the sediment stabilization basins, would also help stabilize river channels and allow vegetation to reestablish. Also, increased turbidity from the dredging operations at the SSB would adversely affect migrating fish.

The preferred plan offers opportunities to minimize the previously addressed negative impacts. Before implementation of the plan, studies would continue to address all justified means and measures of improvement. Further information may be found in exhibit 1, fish and wildlife measures.

Maintenance of Cultural Resources

An evaluation of cultural resources previously identified in the study area is included in the EIS portion of this report. A reconnaissance study has been completed to determine if significant sites exist in the project area. No such sites have been identified in the project area.

ECONOMIC SUMMARY

The preferred plan includes construction of a single retention structure at the Green River site and downstream actions until the structure has become fully effective. The total cost of the plan is $292.2 million.

The recommended plan was formulated using October 1984 prices, an 8-1/8 percent project interest rate, and a 50-year project life. The average annual cost of this plan is $17.9 million on an equivalent annual basis. The resulting benefit-to-cost ratio is 1.55 to 1, with net economic benefits of $9.9 million on an equivalent annual basis.

CHAPTER VI - STAGED CONSTRUCTION

GENERAL

Chapter V identified the NED plan as the preferred plan. This chapter will examine staged construction of the preferred plan, as well as a smaller and larger structure, assuming different sediment budgets. Staging is considered a refinement of the preferred plan and will be further developed and refined during the continued planning and engineering phase, incorporating the latest sediment predictions and cost estimates available. The analysis investigates benefits, costs, and risks associated with staged construction of that structure under various estimated sediment budgets. The discussion closes no options concerning future staging but presents possible strategies for and potential risks of implementing a staging program.

DESCRIPTION OF STAGED CONSTRUCTION

In this analysis, staged construction refers to raising the initial height of the structure following a period in which the storage basin is allowed to fill with sediment. The raises would require modifications to the foundation and raising of the spillway as well.

Considerations for Staging

This approach allows construction of the first increment smaller and less costly than a full size structure. The second stage is constructed only after the previous stage is full and analysis dictates a need for the next increment. Thus, limited resources are used only as needed. While costs may be reduced in early years by building a smaller initial stage, total costs would be greater should the structure be raised to its full height because of construction inefficiencies.

Uncertainties are associated with the sediment projections used in this report. The sediment budget is based on the average observed annual delivery rates since 1981. Should projected estimates prove high, a smaller structure would be adequate. However, as discussed later, certain risks exist when excessive precipitation occurs with attendant flood runoff or mudflows resulting from pyroclastic events.

Another factor affecting staging relates to the physical configuration of the valley and the relationship of structure height to storage capacity. This relationship indicates that for the first 10 percent of storage, (assuming a 177-foot structure), 55 percent of the total cost must be expended. The relationship of incremental costs to incremental raises and incremental storage increases shows that for a small addition of cost, a large increment of storage can be purchased only above a height of 112 feet. Thus, staging for a structure less than 112 feet results in a much higher cost for the volume of storage gained than incremental raises above that height.

METHODOLOGY

As with the sensitivity analysis conducted for the NED plan, sediment budgets have been estimated for 1/2 (1/2 E) and 1-1/2 (1-1/2 E) times the sediment budget (E) used in the report. While the 1/2 E and 1-1/2 E estimated budgets are not a scientific certainty, they do reflect a reasonable range of possible delivery scenarios.

A reactive approach to staging provides the basis for cost development. It assumes a staging strategy of monitoring the impact of annual sediment delivery to project storage. When monitoring indicates efficiency of the structure is decreasing, the next stage is implemented. This strategy reduces initial costs; however, downstream dredging costs would increase to offset reduced storage efficiency until the next stage is completed.

The average annual costs of various sized, staged structures, added to the average annual residual damages, are compared to the cost of maintaining the

base condition. Also presented are risks attributable to infrequent events, such as a 100-year flood event or a mudflow.

COSTS OF STAGED CONSTRUCTION

General

The following section will present assumptions made to develop costs of staged construction using various sediment budgets. Those costs are presented in matrix form and details are described in paragraphs keyed to the matrix.

Assumptions

The costs shown in table VI-1 are based on several assumptions. They relate to when staging would occur and how it would be done.

a. The design budget (E) is representative of the problem although actual delivery rates vary. Lesser and greater sediment budgets (1/2 E and 1-1/2 E) are representative of what could occur, given current knowledge of sediment deliveries.

b. Costs reflect the following implementation schedule:

- o - WY/FY 85: CP&E, plans and specifications
- o - WY/FY 86: Begin construction (cofferdam)
- o - WY/FY 87: First stage of structure effective
- o - WY/FY 88: First stage of structure fully effective

c. For a given sediment budget (1/2 E, E, 1-1/2 E), the initial stage selected represents the smallest and least costly structure satisfying storage capacity needs. Staging would be performed when necessary to increase storage capacity as dictated by monitoring of sediment delivery. The selected initial structure sizes are as follows:

Design Budget	Structure Size: Dam Height (ft)	Structure Size: Spillway Elev. (ft above NGVD)
1/2 E	77	865
E	177	965
1-1/2 E	202	990

d. The base condition (Nov.-Dec. 83) level of protection is maintained by the structure and accompanying downstream dredging.

e. Columbia River navigation channel is maintained.

f. Safe levee heights (permanent levees) are used.

g. Projects designed for 1/2 E initially would use a 77-foot-high first stage. This height was selected for comparative purposes only, as a dredging program would be less costly if the sediment budget is 1/2 E (see NED Sensitivity).

h. The storage basin is full and sediment begins flowing over the structure before the decision is made to add the next stage. This results in a 1-year lapse, with sediment continuing to pass the structure and dredging required downstream. A full structure is defined as the condition where the sediment has reached the spillway elevation. Downstream dredging costs are included in all costs.

i. Under staging, the initial foundation, outlet works and spillway are designed only for minimum structure height but have basic provisions allowing changes for future raises.

j. The succeeding stage would bring the structure to the next larger size. Under 1/2 E, this would result in a 4-stage construction program for a 177-foot structure and a 5-stage program for a 202-foot structure.

Results

Table VI-1 displays the total average annual costs for various structures in millions of dollars. In the lower right-hand corner of each box is an index number which refers to the descriptions below.

Table VI-1

Average Annual Construction Costs of Various Sized Staged Structures

($ Millions)

	DESIGN FOR:		
ACTUAL	1/2 E - 77 ft	E - 177 ft	1-1/2 E - 202 ft
1/2 E	10.3 (1)	13.3 (4)	15.4 (7)
E	23.1 (2)	17.9 (5)	20.0 (8)
1-1/2 E	38.3 (3)	23.4 (6)	24.4 (9)

For the purposes of the risks discussion included in the descriptions below, storage capacity required to fully accommodate the 100-year flood sediment inflow or a mudflow are 21 mcy and 75 mcy, respectively. In Table VI-2, the staging sequence for various sized structures is given. The first number is the dam height while the second designates the year that the stage would be constructed and effective. The number in the lower right-hand corner of each box refers to the discussion below.

Table VI-2
Staging Sequence for Staging Sensitivity Analysis

ACTUAL	DESIGN FOR: 1/2 E - 77 ft	DESIGN FOR: E - 177 ft	DESIGN FOR: 1-1/2 E - 202 ft
1/2 E	77/1987 (1)	177/1987 (4)	202/1987 (7)
E	77/1987 112/1990 142/1993 177/1996 (2)	177/1987 (5)	202/1987 (8)
1-1/2 E	77/1987 112/1990 142/1993 177/1996 202/2002 (3)	177/1987 202/1999 (6)	202/1987 (9)

(1) Design for 1/2 E: Actually Receive 1/2 E. This is a single-stage structure 77 feet high with a total storage capacity of 40 mcy. It represents the lowest overall cost for a first stage. If only the 1/2 sediment delivery occurs, the structure never needs raising. Throughout the life of the structure, risks exist for excess sediment delivery from a 100-year event or the design mudflow. Once completed the structure has no additional capacity to accommodate either the mudflow or the 100-year event.

(2) Design for 1/2 E: Actually Receive E. Initially the structure is built to a 77-foot height. This structure is effective in 1987, as are all structures. This stage performs well until 1989, when pool storage is exhausted and material begins passing downstream, requiring dredging. The

structure is raised 35 feet to a 112-foot elevation in 1990. The structure performs sufficiently through 1991 and begins passing material in 1992 and dredging resumes. In 1993 the structure is raised to 142 feet high. One more raise is required in 1996 to attain a 177-foot structure, with material passing it in 1995. This height would accommodate the E budget and no further stages are required. The capacity of the initial stage is 40 mcy and at its final stage, 299 mcy. The average annual cost shown is the total for all stages. Risks for the first stage are the same as the 77-foot structure described under 1/2 E. These risks are anticipated to remain the same through the fourth stage. Once the fourth stage has been reached sediment levels have decreased and risks begin to improve for the rest of the life of the structure.

(3) <u>Design for 1/2 E: Actually Receive 1-1/2 E</u>. The sequence of construction is similar to the above discussion (2) except that dredging quantities increase in the years when insufficient storage exists. As a result, costs increase for those raises. The staging sequence changes, however, when in 2001 material begins passing the structure again and a 25-foot stage is added in 2002 to raise the dam height to 202 feet. Another stage raising the structure to 202 feet is needed in year 25. Dredging is still required downstream after year 25, however, at that point it becomes more economical to dredge than add another stage. Risks remain high throughout the life of the project because of the high sediment delivery rates.

(4) <u>Design for E: Actually Receive 1/2 E</u>. When designing for E, the least costly approach calls for initially constructing a 177-foot structure with a storage capacity of 299 mcy. It would be effective in 1987. If only half the sediment budget were received, no additional stages would be required. The pool would still fill to the spillway crest but less of the storage between the pool and the S/2 slope would be consumed than if the full budget were received. Downstream actions would be less than if E were received, which would result in a reduction of the total cost for this option over the next condition considered (5). Risks would be reduced over the 77-foot structure (1) because of availability of more storage. Enough storage would exist in this structure until 2002 to accommodate a 100-year event sediment and until 1993 for mudflow sediment.

(5) Design for E: Actually Receive E. This structure is still the same size as (4), 177 feet high, since it was designed for E. Only one stage would be required. The pool will be filled by 1996 and passing some material by 1997. Minimal dredging would be required in the out years but higher than (4). Risks would be higher than (4) because of the structure filling sooner. Capacity exists for the sediment requirements of the 100-year event and mud-flows up to 1995 and 1991, respectively.

(6) Design for E: Actually Receive 1-1/2 E. Again the initial structure is 177 feet. With this budget sand would begin passing the structure in 1998 and the structure would be raised to a height of 202 feet in year 15. The raised structure would fill by 2008 with significant dredging required in the out years. Since these costs occur primarily in the future they do not dramatically impact the discounted average annual costs. Because of the increased sediment delivery, risks are greater than in (5). Storage is available to fully accommodate sediment delivery for a mudflow and 100-year event up to 1989 and 1991, respectively.

(7) Design for 1-1/2 E: Actually Receive 1/2 E. Since the structure is designed for 1-1/2 E, it would be built 202 feet high. No staging would be required, and maximum capacity is 1,162 mcy. This capacity provides storage for extreme events, accommodating mudflows and 100-year events up to 2004 and 2022, respectively. This structure has the lowest risk factor of any considered because of its large capacity.

(8) Design for 1-1/2 E: Actually Receive E. The structure would be built to 202 feet as in (7). No staging required but dredging increased over (7), reflected in increased average annual cost. Initially adequate storage would exist to accommodate extreme events but for shorter periods than (7). Storage would exist to fully accommodate sediment requirements for mudflows and 100-year events up to 1994 and 1999, respectively.

(9) Design for 1-1/2 E: Actually Receive 1-1/2 E. Again, the structure would be constructed to a height of 202 feet. No staging is required but dredging will increase over (8), increasing costs. Initially, structure would have same storage as (7); however, it would fill so that material would pass

structure in 2008. Dredging would continue to be required past then. However, those costs do not significantly impact the discounted average annual costs. Capacity exists to fully accommodate sediment requirements for mudflows and 100-year events up to 1991 and 1994, respectively.

Summary

Table VI-3 presents the accomplishments of various sized structures at the Green River site in relation to annual storage, peak storage (100-year), mudflow storage, streamflow regulation (100-year event) and water quality. The key for symbols show that a clear bubble meets considerations, 1/2 bubble partially meets considerations, and a solid bubble does not meet considerations. As an example, a 112-foot structure on the Green River site can accomplish the following: annual storage to eliminate downstream dredging associated with material eroding from the avalanche is initially 11 mcy. The 112-foot structure fully provides for that storage as evidenced by the clear bubble. In year 5 that requirement drops to 8 mcy and the 112-foot structure also meets that consideration. However, by the 10th year, when the annual requirement is 5 mcy, the dark bubble indicates that the structure does not meet that requirement.

In the same fashion, the ability of a 112-foot structure to provide enough storage for the sediment delivery of a 100-year event and mudflow are shown under the next two headings. The streamflow regulation heading, for a 100-year event, refers to the project's ability to regulate peak flows to prevent spillway overflow.

Comparison of Staged Structures with Dredging

Table VI-4 shows the average annual costs (AAC) developed earlier summed with the average annual residual damages (AAD) in millions of dollars and compared with the sum of the average annual costs plus the residual average annual damages of maintaining the base conditions.

TABLE VI-3

ACCOMPLISHMENTS OF SINGLE RETENTION STRUCTURE

SITE	REG. OUTLET	DAM HEIGHT	EVALUATION CONSIDERATIONS																			
			ANNUAL STORAGE				PEAK STORAGE (100-Yr. Event)				MUDFLOW STORAGE				STREAMFLOW REGULATION (100-Yr Event)				WATER QUALITY			
			1987	1990	1995	2005	1987	1990	1995	2005	1987	1990	1995	2005	1987	1990	1995	2005	RES. TEMP.	D/S TEMP.	D/S ENHANCE.	TURBIDITY
STORAGE CAPACITY CRITERIA			11 mcy	8 mcy	5 mcy	2 mcy	14 mcy	14 mcy	14 mcy	14 mcy	75 mcy	75 mcy	75 mcy	75 mcy								
GREEN RIVER (Base Elev. 810)	No	77	○	●	●	●	◒	●	●	●	◒	●	●	●	●	●	●	●	○	○	◒	●
	Yes	112	○	○	●	●	◒	●	●	●	◒	◒	◒	●	◒	●	●	●	○	○	◒	●
	Yes	142	○	○	○	◒	◒	◒	●	●	◒	◒	◒	●	○	◒	●	●	○	○	◒	◒
	Yes	177	○	○	○	○	○	○	◒	●	○	◒	◒	●	○	○	◒	●	○	○	◒	◒
	Yes	202	○	○	○	○	○	○	○	◒	○	◒	◒	◒	○	○	○	◒	○	○	○	○
	Yes	272	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

○ Meets Considerations

◒ Partially Meets Considerations

● Does Not Meet Considerations

Table VI-4

Staging - Assuming Reaction to Loss of Efficiency

ACTUAL	DESIGN FOR: SRS @ 77 ft 1/2 E			DESIGN FOR: SRS @ 177 ft E			DESIGN FOR: SRS @ 202 ft 1-1/2 E		
1/2 E	SRS	AAC	10.3	SRS	AAC	13.3	SRS	AAC	15.4
		AAD	2.4		AAD	2.4		AAD	2.4
			12.7			15.7			17.8
	D	AAC	8.0	D	AAC	8.0	D	AAC	8.0
		AAD	3.6		AAD	3.6		AAD	3.6
			11.6			11.6			11.6
E	SRS	AAC	23.1	SRS	AAC	17.9	SRS	AAC	20.0
		AAD	2.6		AAD	2.6		AAD	2.6
			25.7			20.5			22.6
	D	AAC	23.3	D	AAC	23.3	D	AAC	23.3
		AAD	7.1		AAD	7.1		AAD	7.1
			30.4			30.4			30.4
1-1/2 E	SRS	AAC	38.3	SRS	AAC	23.4	SRS	AAC	24.4
		AAD	8.7		AAD	7.0		AAD	4.7
			47.0			30.4			29.1
	D	AAC	46.9	D	AAC	46.9	D	AAC	46.9
		AAD	9.8		AAD	9.8		AAD	9.8
			56.7			56.7			56.7

Results from this table indicate that for a 1/2 sediment budget, dredging is always the least costly solution. This was also true for the analysis performed in the NED chapter. The point at which dredging might be preferred to a structure is shown on figures VI-1, VI-2, and VI-3. When compared with similar curves for a single staged structure (as described in chapter IV), there is a slight difference for E and 1/2 E. However, at the estimated sediment budget E, little real difference exists, since staging based on E does not occur until 1/2 E is actually exceeded.

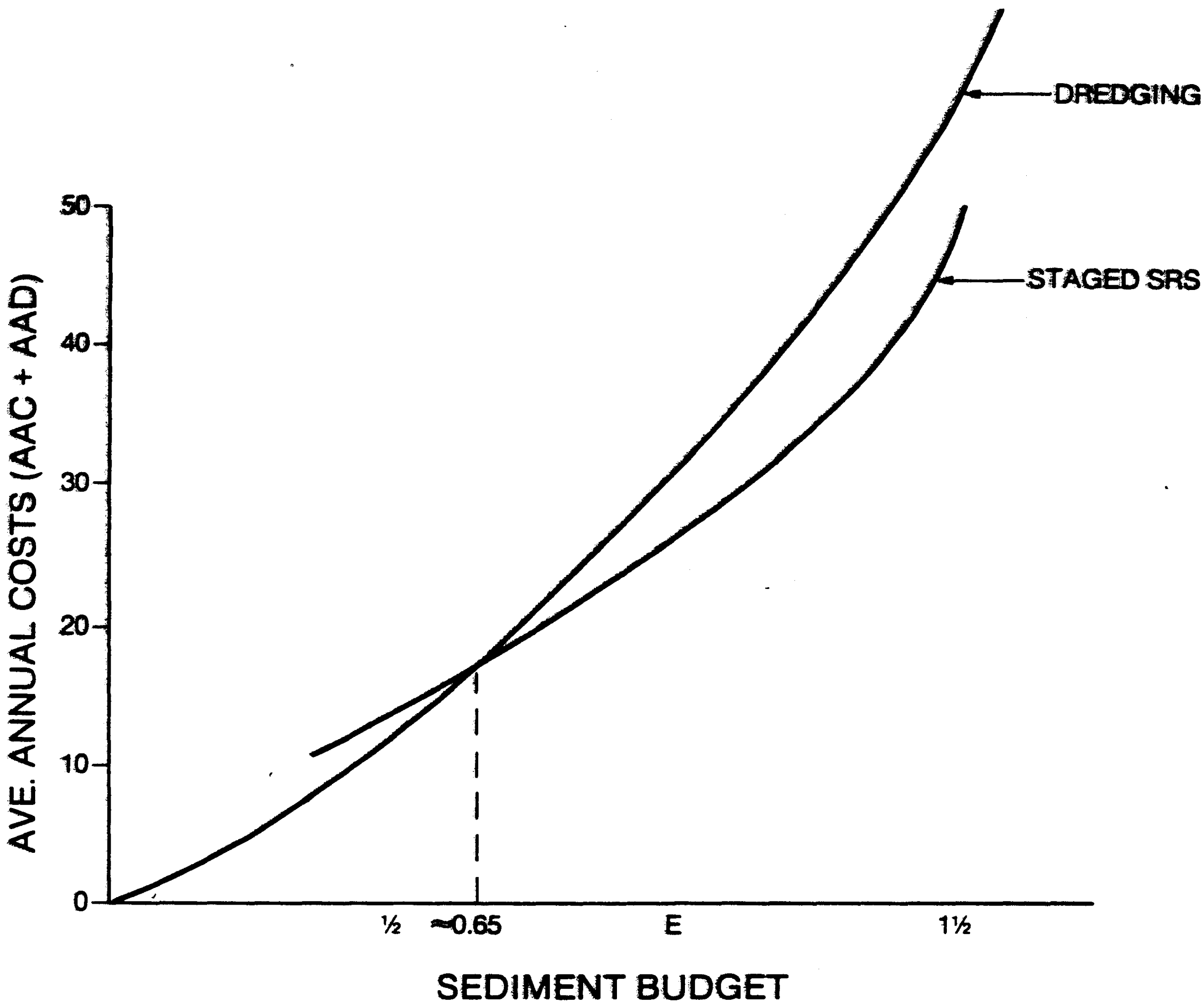


Figure VI-1. Staged Structures Designed for ½E

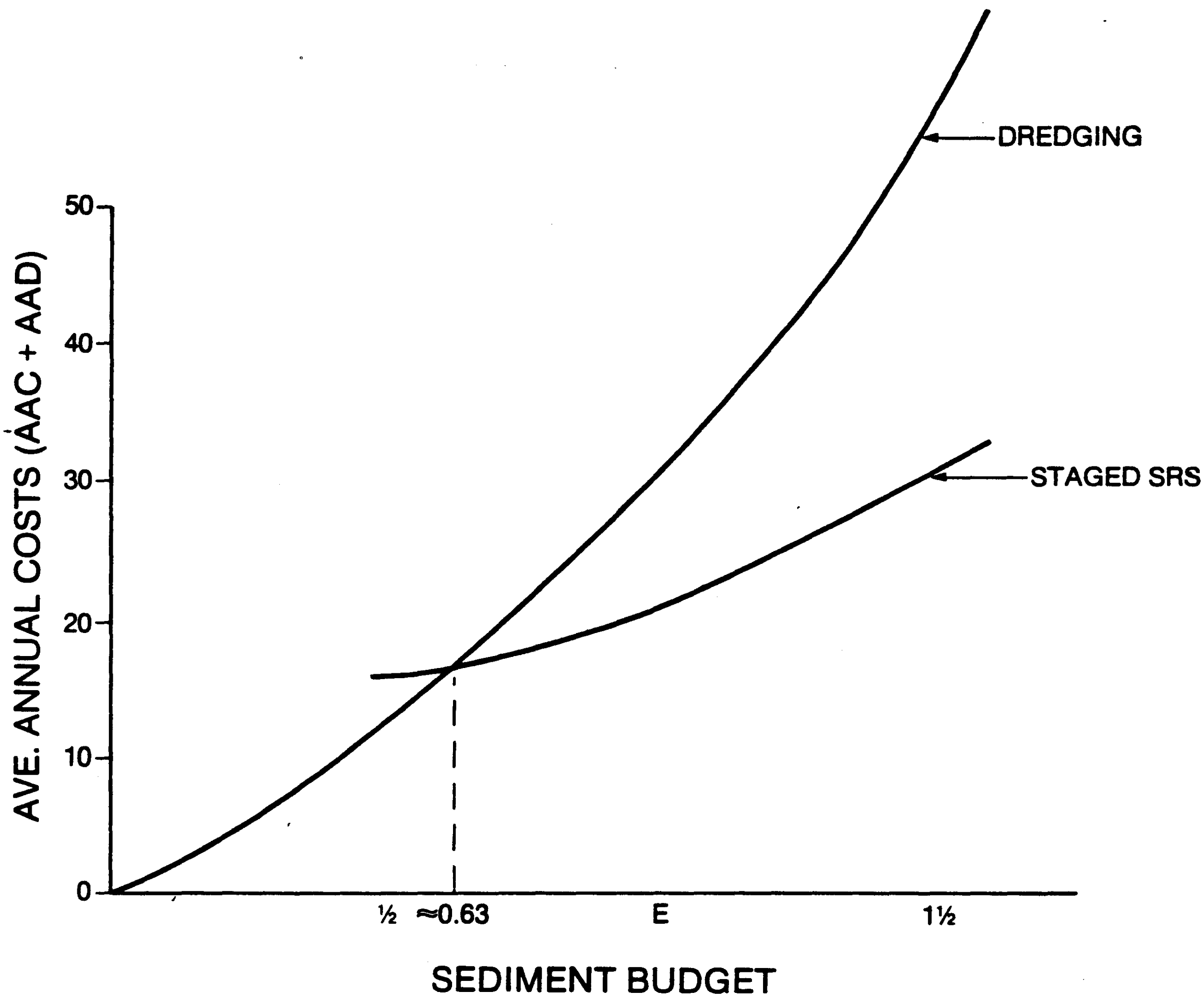


Figure VI-2. Staged Structures Designed for E

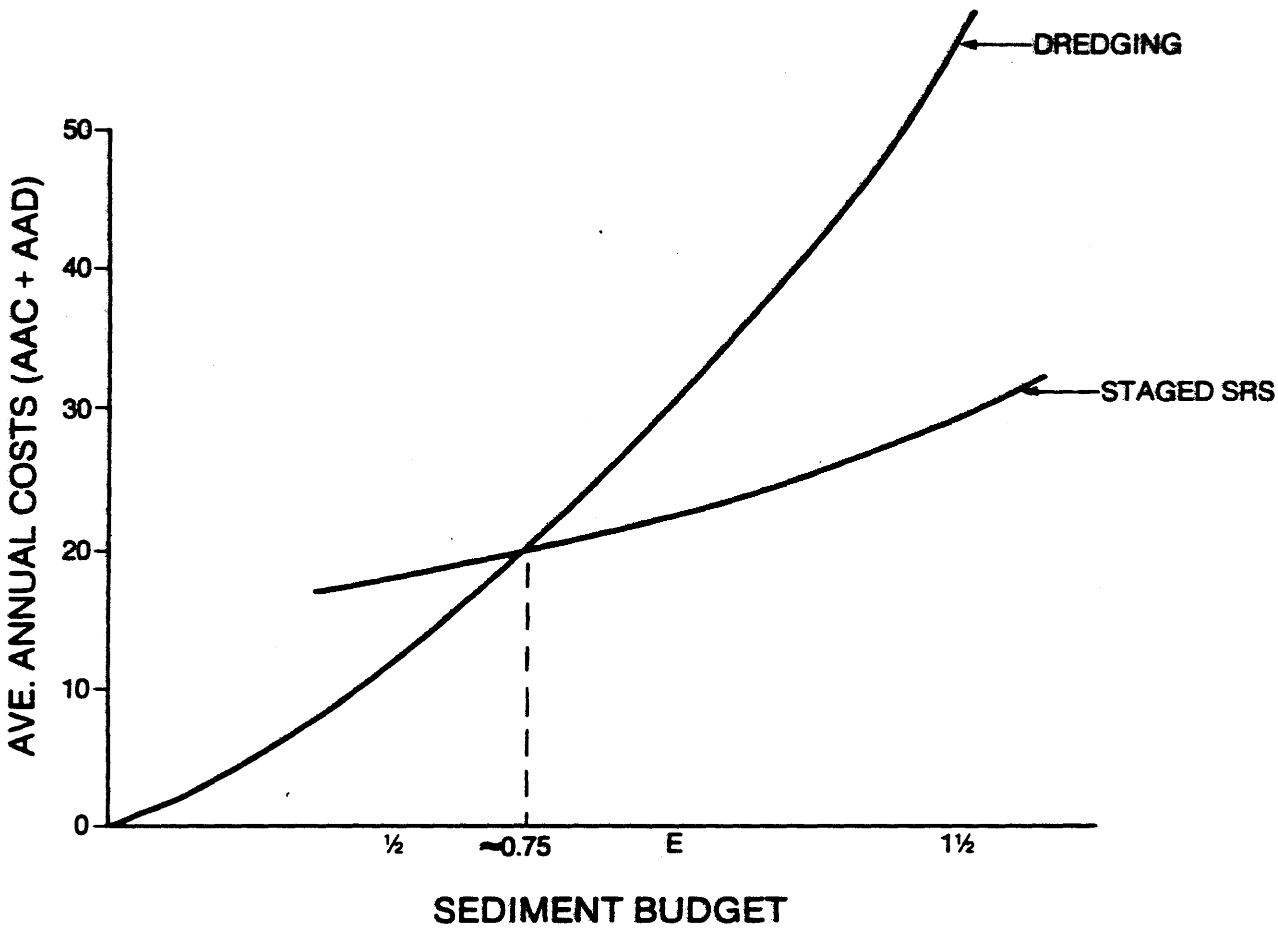


Figure VI-3. Staged Structures Designed for 1½E

Conclusion

The analysis has shown the sensitivity of total costs to costs of staging at certain points in time. If the stages can be delayed far enough out in time, the present value of those costs can be discounted significantly. Future evaluations of staging, taking into consideration all updated results from sediment monitoring and improved costs information, will be performed during the continued planning and engineering phase which follows approval of this report.

CHAPTER VII - FEATURES AFFECTING MANAGEMENT STRATEGY IMPLEMENTATION

GENERAL

The eruption of Mount St. Helens and the emergency actions to correct resultant problems have created new responsibilities for local participation. The high cost and duration of corrective measures are beyond the non-Federal capability to finance. Local agencies and governments have cooperated according to their resources and authority. This chapter looks at past non-Federal involvement and future capability to implement parts of the preferred plan.

INSTITUTIONAL CONSIDERATION

The State of Washington and Cowlitz County have instituted administrative programs and laws which relate to implementation of a long-term plan for the Cowlitz and Toutle River basins. These are discussed below.

Building Moratorium in Flood Hazard Areas

The county initiated a building moratorium following the 18 May 1980 eruption and subsequent mudflow. It prohibits issuance of building permits, mobile home placement, and sewage disposal permits in county-designated flood hazard areas for habitable structures (Cowlitz County, 1983). In the Cowlitz County Watershed Management Plan, the Board of County Commissioners directed their Department of Community Development to continue the building moratorium until a long-term solution is implemented.

Mount St. Helens Flood Warning/Monitoring Network

As described in Section I, this network was developed before the eruption and refined afterwards, primarily because of the threat of failure of Spirit Lake

blockage. This warning system is expected to be kept in operation for the foreseeable future.

Dredge Disposal Site Reclamation/Stabilization Ordinance

In the Cowlitz County Watershed Management Plan, the County Commissioners also directed the Department of Community Development to design an ordinance requiring reclamation of disposal sites in order to insure their future beneficial use. Planning uses for past and future disposal sites is an important management practice. Large quantities of disposal material from future activities will add to those accumulated from past emergency actions.

The Department of Community Development drafted an ordinance that included such reclamation measures as grass seeding and fertilizing, bank protection, and drainage. During the agency review of the draft, it was learned that a portion of the $5 million appropriated by the State legislature in 1983 for dredge spoils site acquisition could be used for site rehabilitation. The State Department of Natural Resources is working on securing long-term funding for managing the State-owned sites. Since many of the largest disposal sites have been or are being acquired by the State, the County concluded that a dredge spoils rehabilitation ordinance was unnecessary at this time.

Local Sponsorship

Current Federal policy requires local interests to participate in project costs. This participation can be as limited as implementing a zoning ordinance or as extensive as furnishing lands, easements and rights-of-way. Other possible local contributions may include responsibility for operation and maintenance of the project and/or sharing in the construction costs. As discussed below, the County and State have already participated as sponsors for emergency measures already undertaken.

The State of Washington, Cowlitz County, and other local interests have already contributed to Federal emergency actions since the eruption. In addition to maintaining the Cowlitz County Flood Warning System, the State has

spent $1 million to procure disposal sites for dredged material and another $3.5 million (Senate Bill 3519) has been expended for related activities. For example, the State acquired lands at the Lower Toutle (LT-1) sediment stabilization basin, where dredging has continued into 1984. After erosion threatened the abutments of the I-5 bridge, the State of Washington Department of Transportation placed revetment and sheet pile at the bridge to prevent further damage and possible closure of this major transportation route.

Within Cowlitz County, local sponsors signed cooperative agreements to provide lands, easements and rights-of-way for emergency levee raising. To date the local Governments have expended approximately $7.4 million on activities resulting from the eruption of Mount St. Helens.

Fish and Wildlife Mitigation

Developing a reasonable and justifiable fish and wildlife mitigation plan for this project is a difficult and complex task. Not only do the fish and wildlife impacts associated with the project need separation from the habitat losses due to the eruption, but fish and wildlife impacts associated with a single retention structure need weighting against the downstream benefits attributable to such a structure. These problems are complicated by the rapidly changing fish and wildlife habitat of the area due to recovery of eruption-caused damages and the ongoing sedimentation problem.

The development of this mitigation plan is based upon the recommendations of the U.S. Fish and Wildlife Service, as found in their Fish and Wildlife Coordination Act Report (CAR); see exhibit 1 of this report. While the recommendations in the CAR exceed those proposed as part of this plan, mitigation does minimize the majority of adverse fish and wildlife impacts directly associated with the plan. Proposed mitigation does not overlap existing federal and state programs or land management plans.

Mitigation proposed in the preferred plan includes the construction of fish bypass facilities as part of the single retention structure. While additional

planning and coordination with the resource agencies will determine the specific facilities eventually constructed, the facilities considered for this report consist of a trap and haul facility for adult migrants with juvenile passage occurring as part of water releases through the regulating outlet and spillway. Construction and evaluation of these facilities will be a Federal cost and operation and maintenance, a state cost-sharing responsibility. Also proposed is the management of reservoir and disposal lands to minimize the loss of wildlife habitat, as described in chapter V.

DIVISION OF RESPONSIBILITIES

Because of the unique nature of the problems arising from the eruption and the novel strategies required for mitigating the impact to flood control and navigation on the Toutle, Cowlitz and Columbia Rivers, the following cost-sharing formula is proposed.

The Recommended Proposal for Cost Sharing

In the recommended proposal for cost sharing, the Federal portion will cover construction cost of the single retention structure including fish bypass facilities; construction costs of all downstream actions; operations and maintenance costs of the retention structure including cost of the sediment monitoring program.

The non-Federal share will be the costs of all lands, easements, rights-of-way for construction and maintenance of the project; maintenance of the disposal sites necessary for downstream actions; all other mitigation costs of the project; operation and maintenance of the by-pass facility; and costs associated with relocation.

Table VII-1

Recommended Proposal for Cost Sharing

	Percentage	
	Federal	Non-Federal[2]/
Single Retention Structure	Construction Costs[1]/	Lands, easements, ROW, Relocations
Downstream Actions	Construction Costs	Lands, easements, ROW, Relocations
Columbia River Dredging[3]/		

1. Includes trapping and hauling and monitoring costs.

2. All other mitigation costs.

3. Responsibilities for Columbia River maintenance dredging are already established under the authorized 40 foot navigation channel Rivers and Harbors Act of 23 Oct, 1962. Federal responsibilities are the cost of dredging. Among the local sponsor responsibilities are providing lands, easements and rights-of-way for disposal areas for construction and subsequent maintenance of the project.

Table VII-2

RECOMMENDED

PROPOSED COST SHARING

	Total Project Cost ($000)	Flood Control: Total Allocation (87% of Total Project	Flood Control: Federal Cost	Flood Control: Non-Federal Cost	Navigation: Total Allocation (13% of Total Project)	Navigation: Federal Cost	Navigation: Non-Federal Cost
SRD at Green River							
Mobilization/Diversion	$ 3,800	$ 3,300	$ 3,300	$	$ 500	$ 500	$
Reservoir Clearing	4,700	4,100	4,100		600	600	
Concrete Dam	47,200	41,100	41,100		6,100	6,100	
Outlet Works	11,400	9,900	9,900		1,500	1,500	
Miscellaneous Works	3,000	2,600	2,600		400	400	
Spillway	29,000	25,200	25,200		3,800	3,800	
SUBTOTAL	$ 99,100	$ 86,200	$ 86,200		$ 12,900	$12,900	
Contingencies	19,900	17,300	17,300		2,600	2,600	
E&D and S&A	16,700	14,500	14,500		2,200	2,200	
O&M/Monitoring	45,000	39,200	39,200		5,800	5,800	
Real Estate	14,300	12,400		12,400	1,900		1,900
TOTAL	$195,000	$169,600	$157,200	$12,400	$ 25,400	$23,500	$1,900
Downstream Actions:							
Cowlitz/Toutle Dredging							
Real Estate	2,000	1,700		1,700	300		$ 300
Sediment Removal	45,000	39,200			5,800	5,800	
SUBTOTAL	$ 47,000	$ 40,900	$ 39,200	$ 1,700	$ 6,100	$ 5,800	
Contingencies	9,000	7,800	7,500	300	1,200	1,200	
E&D and S&A	8,100	7,000	6,700	300	1,100	1,100	
TOTAL	$ 64,100	$ 55,700	$ 53,400	$ 2,300	$ 8,400	$ 8,100	$ 300
Columbia River Dredging*							
Sediment Removal	$ 33,100				$ 33,100	$33,100	
GRAND TOTAL	$292,200	$225,300	$210,600	$14,700	$ 66,900	$64,700	$2,200

* - See footnote [3] from table VII-1.

CHAPTER VIII - SUMMARY OF PUBLIC INVOLVEMENT, VIEWS AND COMMENTS

OVERVIEW

This feasibility report completes the planning process initiated by an earlier study, the Comprehensive Plan for Responding to the Long-term Threat Created by the Eruption of Mount St. Helens, Washington. The Corps forwarded the Comprehensive Plan to the President's office in November 1983. Following a screening process, the plan recommended five strategies for further evaluation:

- o Limited Permanent Evacuation
- o Sediment Stabilization Basins
- o Multiple Retention Structures with Dredging
- o Multiple Retention Structures without Dredging
- o Single Retention Structure

During the months of November and December 1983, numerous meetings were held in the study area to present these strategies to the public and obtain their input. These presentations also included a discussion of alternatives for Spirit Lake, also covered in the Comprehensive Plan report. The input for the Spirit Lake solution, addressed in the Spirit Lake Decision Document and EIS, will not be addressed in this report.

Because the Feasibility Report utilizes much of the information and analysis developed during the preparation of the Comprehensive Plan, only one public meeting was scheduled during the 45-day public review period that was held in Longview, Washington on 29 November 1984. A formal presentation describing the preferred plan preceded public testimony.

This section summarizes the public, state, agencies, and local government reactions to the Comprehensive Plan and Feasibility Report for responding to the eruption of Mount St. Helens. It utilizes the public meeting transcripts, oral and written comments made at the meetings, and letters submitted for the record following the meetings. A synopsis of the comments on one of the principal components of the plan, the sediment strategy, is contained in the following paragraphs.

SYNOPSIS OF COMPREHENSIVE PLAN COMMMENT

The public reaction to strategies designed to solve the sediment problem ranged from a preference for continuation of the current dredging program to

recommendations for construction of a sediment retention structure on the Toutle River. Major public sentiment backed the solution which would resolve the problem by retaining the material in the Toutle River. A large majority expressed support of the single retention structure on the Toutle above its confluence with the Green River. People from the Toutle Valley generally opposed any dams on the Toutle River.

The Governors of Washington, Oregon, and Idaho, and the Community Consensus Position (which was signed by 39 representatives of local government, service and civic organizations) also expressed support for the single retention structure. The U.S. Fish and Wildlife Service agreed to this strategy with provisions for fish passage. The U.S. Geological Survey preferred to control sediment as close to its source as possible to minimize impacts of downstream sediment transport and stated a concern that a large increment of storage (100 mcy) should be provided on any structure as early as possible to accommodate the possibility of a major event.

Public Involvement Program

The public involvement period began on 29 November 1983, with the news release announcing availability of the Comprehensive Plan report and public meeting dates. Comments for the record were received through 5 January 1984. During that 37-day period, the Corps made 12 presentations to an estimated 1,300 people.

The major component of the public involvement program centered on six public meetings during December. These meetings were held at locations and times indicated below.

Date	Location	Time
5 December	Vancouver, Washington	1300
5 December	Toutle, Washington	1930
6 December	Castle Rock, Washington	1930
7 December	Kelso, Washington	1930
8 December	Kelso, Washington	1230
8 December	Woodland, Washington	1930

In addition to the six formal public meetings, the Corps gave six other presentations to local groups requesting background on the study.

Date	Location	Group
22 November	Longview, Washington	Longview Chamber of Commerce
1 December	Toutle, Washington	Residents of Toutle
9 December	Olympia, Washington	Washington State Agencies
13 December	Vancouver, Washington	Mount St. Helens Scientific Advisory Board
14 December	Longview, Washington	Longview Rotary
14 December	Olympia, Washington	Washington Legislative Select Committee
20 December	Woodland, Washington	Woodland Chamber of Commerce

The first public meeting held in Vancouver, Washington, provided an opportunity for residents of the Portland-Vancouver metropolitan area to give their views. The afternoon meeting also attracted staff from various agencies. Navigation interests were represented since Portland and Vancouver are the two major ports in the region.

A large percentage of the local population attended the Toutle public meeting. Although not threatened by flooding from the sediment problem, people in the Toutle Valley would be affected by a sediment retention dam on the Toutle River. In addition, the population felt threatened by any failure of the natural dam impounding Spirit Lake.

Castle Rock, located on the Cowlitz River near its confluence with the Toutle River, would be endangered not only by flooding from a breach of the Spirit Lake dam but also from loss of flood control caused by deposition of sediment in the Cowlitz River. This third public meeting was the first where both issues were of equal concern to the attendees.

The next public meeting took place in the Longview-Kelso area, the most populated and developed area threatened by flooding. This evening session had the highest attendance of the six meetings. The major concerns were both flood control and navigation, affecting both individuals and businesses.

The fifth meeting was also held in the Longview-Kelso area during the afternoon. This session was timed to encourage attendance by night shift workers and elderly people. Some staff from local agencies and businesses also attended.

The final public meeting occurred in Woodland, a city on the Lewis River. The only direct impact on this city would develop if the Corps implemented the B_1 alternative for the Spirit Lake component, since this alternative included the discharge of water into the Lewis River. Discussion at this meeting focused on alternatives for a permanent Spirit Lake outlet.

Meetings were planned at locations and times to insure maximum attendance. Advance notice of the meetings appeared in local newspapers and in announcements over television and radio. The format of each meeting included a formal presentation of the study, public testimony, and a question and answer period. It is estimated that a total of 1,000 people attended the meetings. In addition, 257 written comments were received initially, with another 69 comment sheets received through the mail.

Public Comment by State, Agencies and Other Public Groups

Congressman Don Bonker, State of Washington

Sediment Strategy. Accepts Comprehensive Plan recommendation that the single retention structure is the best and the most cost-effective solution.

State of Washington

Sediment Strategy. Prefer single retention structure located on the Toutle River above its confluence with the Green River, based on the following concerns:

(a) Sediment should be contained in the upper reaches of the Toutle River above its confluence with the Green River,

(b) Permanent solution should minimize impacts on residents, transportation routes, and on fish and wildlife.

Other Concerns. The Administration's proposal for local and State cost-sharing, as described in the Comprehensive Plan is totally unacceptable. Traditional cost-sharing formula should apply and include costs for fish and wildlife mitigation measures. Favor a greater margin of safety and subsequent permanent Spirit Lake level 10 to 20 feet below the recommended 3,440 feet.

State of Oregon

Sediment Strategy. Supports the single retention structure based on the following concerns:

(a) Least costly alternative,

(b) Less risk than with multiple retention structures,

(c) Immediate action so congressional authorization can occur in 1984,

(d) Impairment of navigation access to ports of lower Columbia of serious economic concern.

Federal Emergency Management Agency, Washington, D.C.

Sediment Strategy. Urge rapid progress towards the final solution.

Other Concerns. Support 100-year flood level as minimum flood protection level to be achieved and maintained.

U.S. Fish and Wildlife Service

Sediment Strategy. Concerned about fish passage and loss of wildlife habitat. Recommend single retention structure because impacts to fish and wildlife are less damaging than with the multiple retention structures.

Department of Interior, Geological Survey

Sediment Strategy. Sediment management strategy should provide a large increment of storage (100 mcy or more) as soon as possible and impound the sediment as close as possible to its source. This strategy would minimize negative impacts of downstream sediment transport and accommodate sediment yields generated by major volcanic, seismic, and hydrologic events.

Other Concerns. Mount St. Helens is in an episode of eruption that could last for several decades. This is a period of geologic and hydrologic instability which must be planned for. There are concerns about the impact of Spirit Lake discharge on the chemical and biological quality of alternative receiving waters.

Community Consensus Position

Sediment Strategy. Single retention structure on North Fork Toutle at the Green River site is the preferred alternative for sediment control.

Other Concerns. If further studies indicate safety problems exist for west side tunnels, would not oppose tunnel to Smith Creek as long as mitigative measures are implemented to protect Lewis River drainage.

Urges use of the traditional formula wherein the Federal Government pays 100 percent of construction costs.

The following local government, service, and civic organizations signed the Community Consensus Position document:

- o Cities, County, and Regional Government
  - Cowlitz County Board of Commissioners
  - City of Longview
  - City of Kelso
  - City of Castle Rock
  - City of Kalama
  - Cowlitz-Wahkiakum Governmental Conference

- o Service Districts
  - Public Utility District No. 1 of Cowlitz County
  - Longview School District Board of Directors
  - Kelso School District Board of Directors
  - Castle Rock School Board of Directors
  - Kalama School District
  - Beacon Hill Sewer District Board of Commissioners
  - Consolidated Diking Improvement District No. 1 (Longview)
  - Consolidated Diking Improvement District No. 3 (Kelso)

- o Ports
  - Port of Longview Board of Commissioners
  - Port of Kalama
  - Port of Portland
  - Port of Astoria Commission
  - Pacific Northwest Waterways Association

- o Political Organizations
  - Cowlitz County Republican Central Committee
  - Cowlitz County Republican Men's Club
  - Cowlitz County Republican Women's Club
  - Cowlitz County Democratic Central Committee

- o Civic Organizations
  - Cowlitz Economic Development Council
  - Longview Chamber of Commerce
  - Kelso Chamber of Commerce
  - Castle Rock Chamber of Commerce
  - Kalama Chamber of Commerce
  - Yale/Cougar Community Council

- Unions
  - International Longshoremen's & Warehousemen's Union Local 21
  - United Food and Commercial Workers, Local 367
  - Association of Western Pulp and Pulp Workers Local 153

- Service Organizations
  - Kelso Rotary Club
  - Pioneer Lions Club

- Other Organizations
  - Mount St. Helens Protective Association
  - Willapa Hills Audubon Society
  - Castle Rock Lions Club
  - National Association of Women in Construction
  - Longview Early Edition Rotary

Cowlitz Conservation District, Kelso, Washington

Sediment Strategy. Recommends a single retention structure as far upstream as feasible above the confluence of Green River and North Fork Toutle River.

Other Concerns. Mount St. Helens disaster is a national concern. Federal Government should pay for all expenses.

Port of Portland, Portland, Oregon

Sediment Strategy. Urges the single retention structure as the best approach.

Other Concerns.

(a) Recognize that this is a national issue.

(b) Disagree that more study will improve sediment estimates. Feel current ones are best available.

(c) Nothing suggests that waiting will lessen magnitude of problem.

(d) Single retention structure has advantage over multiple retention structures in flexibility, flood control, and environmental impacts.

Port of Lewiston, Lewiston, Idaho

Sediment Strategy. Recommends single retention structure.

Other Concerns. Mount St. Helens is a national issue and should not be approached through cost-sharing means of local government. Prevent sediment from entering the Columbia River and impacting navigation in the river channel.

Port of Vancouver, Vancouver, Washington

Sediment Strategy. Recommends single retention structure in the interest of time and in the long term, money.

Other Concerns. Maintain a safe and assured 40-foot channel from the Pacific Ocean to the Port of Vancouver. Action is needed now.

Mount St. Helens Chamber of Commerce (Toutle River Valley)

Sediment Strategy. Continue to dredge the Cowlitz and Columbia Rivers.

Idaho Transportation Council

Sediment Strategy. Single retention structure is described as satisfying most criteria and reducing the costs of navigation.

Other Concerns. Impairment of navigational access to the lower Columbia River is a serious economic concern to Idaho. Columbia River navigation channel is essential to the economy of the Pacific Northwest and should be maintained.

Pacific Rim Trade Association

Sediment Strategy. Solution should be implemented now to contain material in the Toutle Basin, leaving the available Columbia River dredged disposal sites for other dredging needs.

Other Concerns. Depend very heavily on the Columbia River and its tributaries to transport products. Action should be taken immediately.

Weyerhaeuser Company, Longview, Washington

Sediment Strategy. Better information is needed about the amount, timing and source of sedimentation in the rivers before determining the best way to handle the sediment problem.

Other Concerns. Mitigation for fish and wildlife is secondary to life and property concerns and is not needed. Funding of the solution(s) should be entirely from the Federal level.

Mount St. Helens Scientific Advisory Board

Sediment Strategy. No position stated.

Other Concerns.

(a) Safety of people downstream should be first priority.

(b) Flexibility must be part of any selected alternative.

(c) Presented these recommendations to U.S. Forest Service.

Summaries of Written and Oral Responses

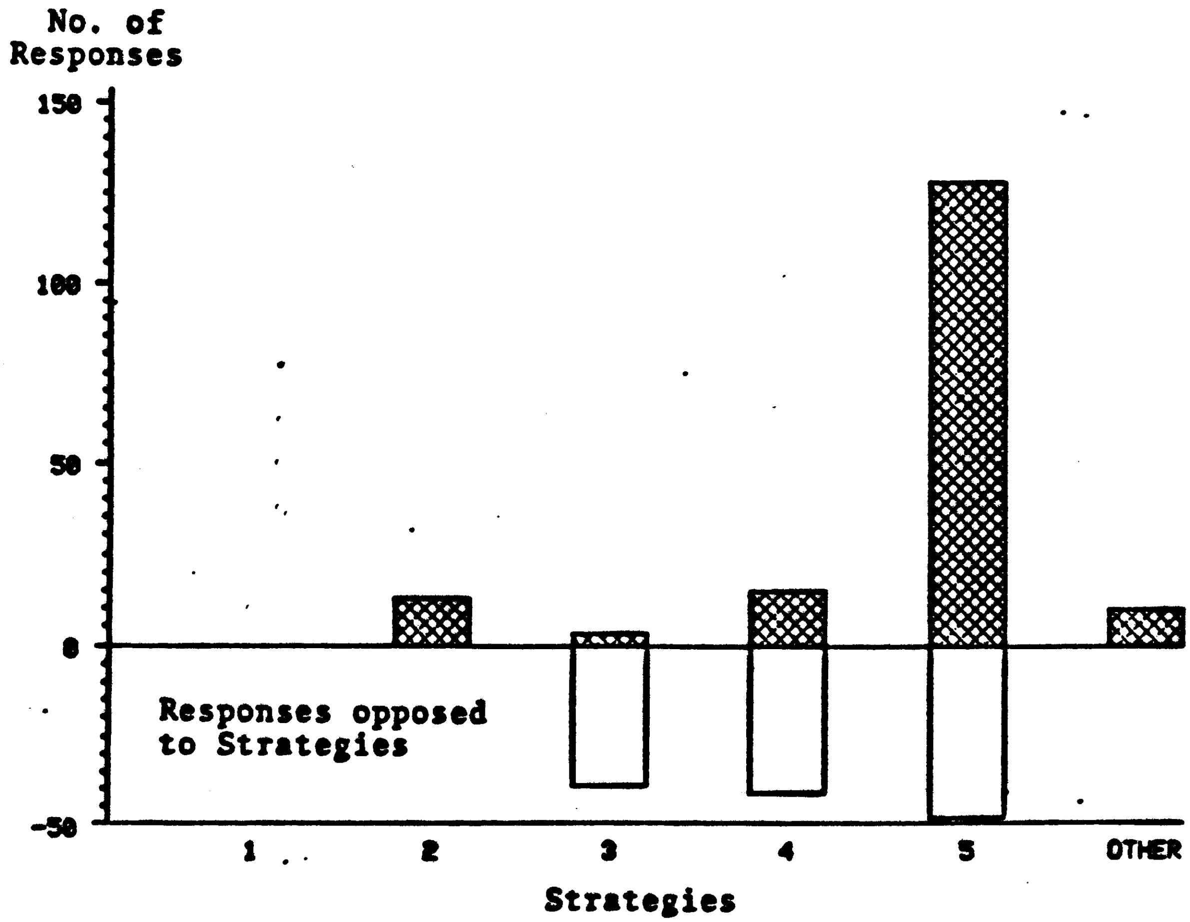
The consensus of public testimony supported the single retention structure as a solution to the sediment problem. The two exceptions were the Mount St. Helens Chamber of Commerce, who preferred continued dredging, and the Weyerhaeuser Company, who recommended waiting for better information before making a selection. The U.S. Geological Survey stated no preference among the strategies, urging only that sediment be controlled as close to its source as possible.

Other concerns expressed by the public included the following points. Those commenting on cost-sharing supported 100 percent Federal funding. Many comments requested quick action for a solution to both the Spirit Lake and sediment problems. The U.S. Geological Survey conveyed several technical concerns about various alternatives to both the Spirit Lake and the sediment problems. The Federal Emergency Management Agency advocated the 100-year flood level as the minimum maintained for the communities along the Cowlitz River. The U.S. Forest Service, the Federal management agency for the lands around Spirit Lake, did not provide a position on the various alternatives.

This summary of responses as shown in Figure VIII-1, reflects a range of community sentiments, extending from a community interested only in impacts of a specific Spirit Lake outlet (Woodland) to a community concerned only in effects of single retention structures (Toutle). It encompasses a cross section of populations from large communities to small and of publics including environmental groups, agencies, counties, and ports.

A common area of agreement among all providing their views was the need for a quick solution to the problems created by the eruption of Mount St. Helens and a desire for relief from cost sharing.

In addition, several informal groups of individuals provided written and oral recommendations to various levels of the United States Army Corps of Engineers and to the Army Secretariate. An example of this input was that of Alden Jones, who opposed any dam construction based upon the premise that the Toutle River was armoring itself sufficiently from natural means so that the flood threat from sediment would correct itself in time.



1 = Limited Permanent Evacuation

2 = Sediment Stabilization Basins

3 = Multiple Retention Structures with Dredging

4 = Multiple Retention Structures without Dredging

5 = Single Retention Structure

Figure VIII-1. Summary of Response to Comprehensive Plan

SYNOPSIS OF FEASIBILITY REPORT COMMENT

Public Involvement Program

The Public meeting on the Feasibility Report attracted 103 people, 27 of whom testified. Of the individuals who spoke at the meeting 15 supported and 12 opposed the preferred plan as shown in table VIII-1. Most of the opponents were members of the Toutle Valley Preservation Association and residents of Toutle Valley.

No new issues surfaced at that public meeting that were not discussed during the 1983 meetings. All speakers urged that a quick decision should be made on which alternative will be implemented. Most speakers also opposed the proposal for local cost sharing of lands, easements and rights-of-way.

Table VIII-1 TESTIMONY AT
29 NOVEMBER 1984 PUBLIC MEETING

Opposition	12 Total
Toutle Valley Preservation Association	
Mount St. Helens Chamber of Commerce	
Individuals (10)	
Support	15 Total
Washington Department of Emergency Management	
Cowlitz County Board of Commissioners	
Cowlitz Economic Council	
Longview Chamber of Commerce	
Longview Fibre Company	
Longview Treatment Plant (Water Dept.)	
Pacific Northwest Waterways Association	
Port of Longview	
Port of Kalama	
Port of Portland	
Cowlitz County League of Women Voters	
Individuals (4)	

Public Comment by State, Agencies and Other Public Groups

In addition to oral testimony presented at the public meeting, written comments were received from Federal, State and local agencies, groups and private individuals during the 45-day public review. A graphic summary of written responses by group and position is shown in figure VIII-2. These letters and appropriate responses are contained in exhibit 2 of this report.

As with the oral testimony written opposition to the preferred plan came primarily from individuals in the immediate study area, some of whome are members of the Toutle Valley Preservation Association. No Federal, State or local agency opposed the preferred plan although some changes were suggested. Local agencies and individuals opposed cost-sharing from local sources. Some State and Federal agencies requested more fish and wildlife mitigation as a federal portion of the project costs. Responses from agencies are summarized below.

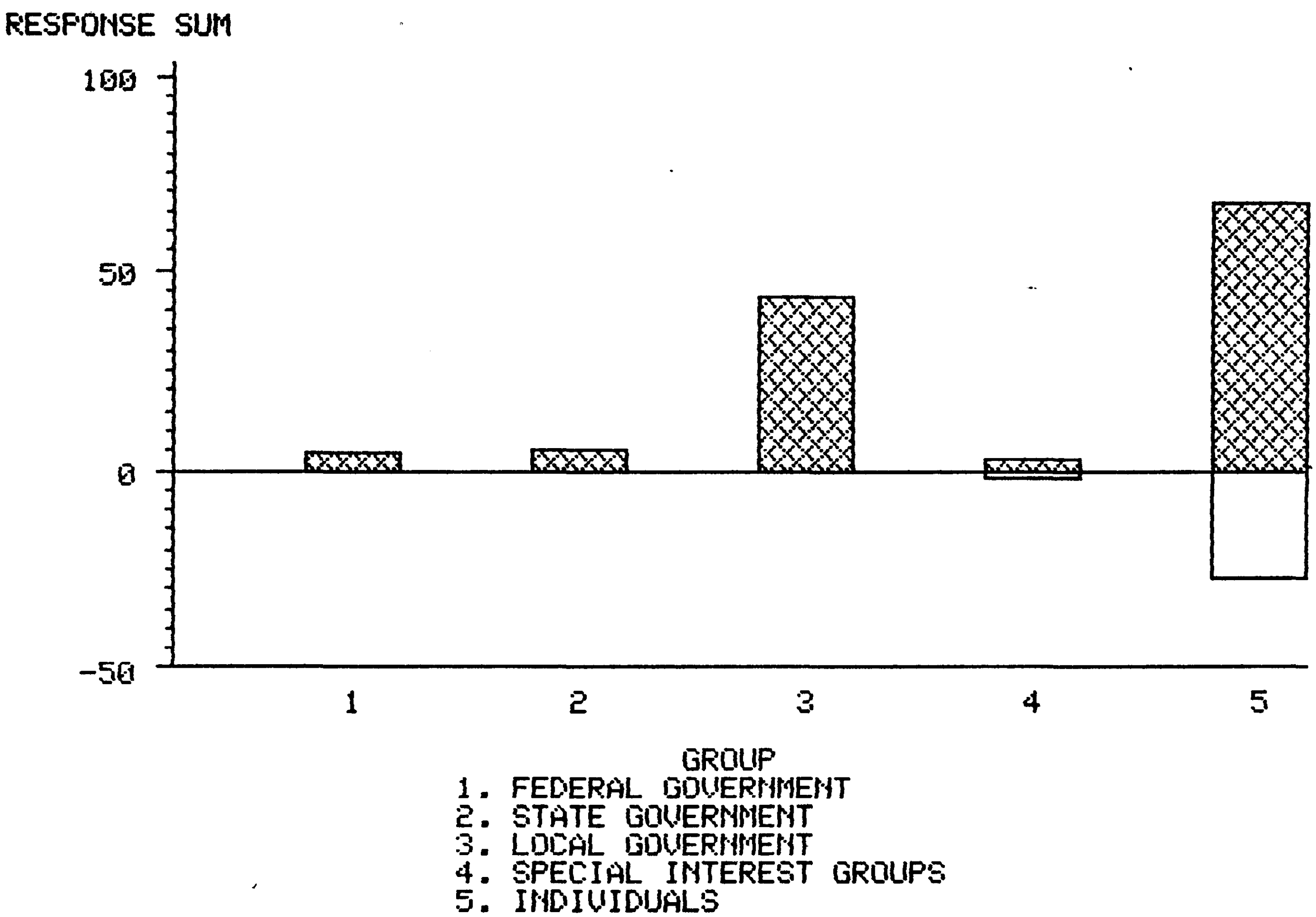


Figure VIII-2 Summary of Response to Feasibility Report

State of Washington

The State supports quick construction of the preferred alternative. Fish and wildlife mitigation costs should be part of Federal funding. The proposed cost-sharing responsibilities are acceptable.

Department of the Interior
(Fish & Wildlife Service & U.S. Geological Survey)

This agency felt that the environmental impact statement should have discussed the preferred plan in more detail. They specifically cited lack of fish & wildlife impacts as a major dificiency. They also felt the estimate of sediment erosion was too conservative. Some potential hazards such as upstream lakes, mudflows and eruptions were not emphasized enough. Therefore, provision should be made in design of the SRS to accomodate a major mudflow without displacing the pool.

Department of Health & Human Services

This agency supported implementation of Alternative 1 from the Comprehensive Plan - (limited permanent evacuation). They did not comment on any alternatives currently being considered.

Environmental Protection Agency

This agency felt that the environmental impact statement should have been more detailed in discussing the preferred alternative. Fish & wildlife impacts were not discussed in enough detail.

Department of Agriculture

(U.S. Forest Service)

This agency did not comment because the proposed work was outside the National Volcanic Monument which they manage.

Department of Commerce

(National Marine Fisheries Service)

This agency was concerned that provisions for anadromous fish passage should be included in design and construction of the SRS.

Department of Transportation

This agency had no comment because they are no longer involved with any road systems in the Toutle River Valley.

Community Consensus Position (43 Entities)

The preferred alternative is the best choice for solving potential flooding and navigation problems. The concept of cost sharing is understood and supported in concept by the local governments, but they do not feel this cost should be borne by the cities or county. A solution to the sediment problem needs to be implemented as soon as possible.

- Cities, County, and Regional Government
  - Cowlitz-Wahkiakum Governmental Conference
  - Cowlitz County Board of Commissioners
  - Clark County Board of Commissioners
  - Columbia County Board of Commissioners
  - Skamania County Board of Commissioners
  - City of Longview
  - City of Kelso
  - City of Castle Rock
  - City of Kalama
  - City of Woodland
  - Town of Cathlamet

- Service Districts
  - Public Utility District No. 1 of Cowlitz County
  - Longview School District Board of Directors
  - Kelso School District Board of Directors
  - Castle Rock School Board of Directors
  - Kalama School District
  - Beacon Hill Sewer District Board of Commissioners
  - Consolidated Diking Improvement District No. 2 (Woodland)
  - Consolidated Diking Improvement District No. 3 (Kelso)
  - Cowlitz Economic Development Council

- Ports
  - Port of Longview Board of Commissioners
  - Port of Kalama
  - Port of Portland
  - Port of Vancouver, U.S.A.
  - Pacific Northwest Waterways Association
  - Wahkiakum Port District #2

- Political Organizations
  - Cowlitz County Republican Central Committee
  - Cowlitz County Republican Men's Club
  - Cowlitz County Republican Women's Club
  - Cowlitz County Democratic Central Committee
  - Cowlitz County Democratic Men's Club

- o Civic Organizations
  - Longview Chamber of Commerce
  - Kelso Chamber of Commerce
  - Castle Rock Chamber of Commerce
  - Kalama Chamber of Commerce
  - Yale/Cougar Community Council

- o Unions
  - International Longshoremen's & Warehousemen's Union Local 21
  - United Food and Commercial Workers, Local 367
  - Association of Western Pulp and Pulp Workers Local
  - Teamster's Local #58
  - Carpenter's Union Local #1707

- o Other Organizations
  - Willapa Hills Audubon Society

Toutle Valley Preservation Association & Mt. St. Helens Chamber of Commerce

These groups feel that erosion of the debris avalanche is stabilizing faster than anticipated in the Feasibility Report. Therefore, other minimal, non-structural actions such as bank protection and vegetation planting would be effective in stopping downstream problems.

Weyerhaeuser Company

This company emphasized the need to refine the sediment budget before final selection of the preferred plan. The Green River Site for an SRS is supported if current analysis is substantiated by continuing sediment monitoring. No additional resource mitigation is justified beyond that indicated in the Feasibility Report. Project funding should be a federal responsibility.

FINAL

CHAPTER IX - ENVIRONMENTAL IMPACT STATEMENT AND SECTION 404(b) EVALUATION

Cowlitz Toutle Feasibility Study

The responsible lead agency is the U.S. Army Engineer District, Portland.

Abstract

The 18 May 1980 eruption of Mount St. Helens left a debris avalanche containing an estimated 3 billion cubic yards of material on the upper reaches of the North Fork Toutle River. Material eroding from the avalanche moves downstream, some of it passing through to the ocean and the remainder depositing in the river channels. The sediment deposits, if not removed, could eventually create a flooding possibility for downstream urban areas. An active dredging program, however, has removed the infill and maintained the 100-year flood protection authorized by PL 98-63. A number of alternative measures to control sediment movement have been considered, including no action and a nonstructural plan to evacuate permanently a large portion of the lower Cowlitz flood plain while raising levees to increase flood protection for Kelso and Longview. Structural measures considered include sediment stabilization basins, multiple retention structures both with and without dredging, and a single sediment retention structure. A sediment retention structure located on the North Fork Toutle upstream of the Green River confluence was selected as the preferred alternative. With this plan the maximum amount of sediment would be retained in the upper watershed. The retention structure could be built in stages, allowing flexibility in responding to actual rates of erosion from the debris avalanche. The environmental effects of the preferred alternative include blocking the passage of anadromous fish into the North Fork Toutle River above the confluence with the Green River. Fish passage is proposed to mitigate this impact. Retention of sediment behind the structure would substantially reduce sediment deposition in the Toutle and Cowlitz Rivers, allowing the re-establishment of riparian vegetation and the natural restoration of fish and wildlife populations and habitat downstream of the structure. Requirements for dredging in the lower Cowlitz and Toutle Rivers to maintain flood protection would be reduced. Sedimentation in the Columbia River would be reduced, requiring less dredging to maintain the navigation channel and less disposal of dredged material on riparian lands. Economic benefits would result from the reduction in potential flood damages. Adverse social and psychological conditions now evident and that would increase with a no-action situation, would be lessened as residents received assurance that their homes and communities were once again safe from destruction by flooding.

For further information please contact:
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Telephone: (503) 221-6094
(FTS) 423-6094

Note: Information, displays, and maps referred to in the main report and appendixes are incorporated by reference into this EIS.

SUMMARY OF MAJOR CONCLUSIONS AND FINDINGS

Preferred Alternative

The Corps of Engineers considered five alternative plans to control the movement of sediment from the debris avalanche on Mount St. Helens. The alternatives include: limited permanent evacuation, sediment stabilization basins, multiple retention structures with dredging, multiple retention structures without dredging, and a single retention structure (SRS). No action was also considered.

Engineering and economic studies determined that a single retention structure on the Toutle River would be the most efficient and cost-effective means of controlling sediment from the debris avalanche. The studies analyzed three sites as potential locations for a single retention structure: LT-3, on the main stem Toutle River at river mile (RM) 9.5; Kid Valley, on the North Fork Toutle River at RM 6.9; and Green River, on the North Fork Toutle River at RM 13.5. Based on these analyses and their potential environmental effects, the Green River site with a 177-foot structure and associated actions was selected as the preferred alternative.

Physical Effects

An SRS at the Green River site would impound 299 mcy of sediment covering 3,267 surface acres during the 50-year project life. Ultimately 411 mcy of sediment would be trapped over 4,100 surface acres. Total project lands at the SRS site would total 7,470 acres. Staged construction could provide flexibility in responding to actual sediment accumulation. Ponding of water would occur behind the structure, which would detain river flows and increase sediment trapping efficiencies. Two years of downstream dredging in the Cowlitz and five years in the Columbia would be necessary to remove material eroded downstream of the site and material passed downstream during construction.

Biological Effects

The Green River SRS would block passage of anadromous fish to upstream areas. However, of the sites considered, the Green River site would block the least amount of area and would allow unimpeded fish passage to the South Fork Toutle River and the Green River. If fish passage is provided around this structure, this fish blockage would be alleviated. Over the period of sediment delivery, sediment would be trapped behind this structure and would cover the North Fork Toutle River and portions of tributary streams.

The Green River sediment retention structure would allow the stream channel downstream to stabilize, and riparian wetland and upland areas to develop. Establishment of vegetation behind this structure would be retarded by sediment accumulation. Once sediment stabilization is achieved, vegetation would reappear, developing into wetlands or wet meadows.

Social and Economic Effects

Positive effects to local social and economic conditions would result from the control of sediment movement by a retention structure at the Green River site. Community viability in the lower Cowlitz floodplain would improve with this alternative because the threat of flood damages would be reduced. Business and industry could invest and expand without the uncertainties which had existed due to the continuing flood threat.

Cultural Resources

Investigation of the site of the Green River SRS and the sediment impoundment area indicates that no significant cultural resources are present in the project area.

I. PURPOSE AND NEED

This draft Environmental Impact Statement accompanies a draft Feasibility Report. The purpose of the feasibility study is to develop plans for a permanent solution to the sediment problem and to recommend congressional authorization and funding for construction.

Public Concerns: Intense public concern exists for protection of life and property in the areas of the Lower Cowlitz and Toutle River valleys subject to the threat of flooding resulting from continued sedimentation. Material eroding from the debris avalanche on Mount St. Helens is being deposited on the lower river channels, increasing the risk of flooding in the developed areas. Containing the greatest population concentration in Cowlitz County, the lower Cowlitz River flood plain is the area of greatest potential damage. Also, the long-term preservation of the economic and social viability of the communities on the lower Cowlitz is a major concern.

The fish and wildlife resources of the Toutle River system are the natural resources of greatest concern in the study area. Mudflows following the 18 May 1980 eruption severely harmed fish and wildlife populations, but the passage of time is expected to correct the damage done by nature. All of the alternative sediment control plans have been evaluated to determine their effects on the long-term recovery process of fish and wildlife habitat and populations.

Planning Objectives: The primary planning objectives of this study are: (1) the reduction of flood threat to life, property, and transportation systems and (2) the maintenance of navigation on the Columbia River. Other planning objectives encompass protection of water quality, reduction of bank erosion (including areas used for dredged material disposal), protection of fish and wildlife resource, maintenance of cultural resources, and minimization of adverse effects on the local economy.

II. ALTERNATIVES

INTRODUCTION

This Feasibility Report constitutes the second major stage in evaluating alternative measures and plans for controlling sediment from the Mount St. Helens debris avalanche. The first stage involved the Comprehensive Plan, which identified and screened through a plan formulation process measures to control the sediment or reduce damages. These measures and the screening process are described in appendix A, "Comprehensive Plan, the Planning Process." The analysis of alternative actions in the Comprehensive Plan determined the single retention structure alternative the most efficient and cost-effective means of meeting the planning objectives. The Feasibility Report follows up on the Comprehensive Plan by focusing on three alternative locations and a range of alternative sizings for the single retention structure.

This Environmental Impact Statement covers both the alternative plans described in the Comprehensive Plan and the alternative site locations for the single retention structure analyzed in this Feasibility Report. This is consistent with the regulations of the Council on Environmental Quality for implementing the procedural provision of the National Environmental Policy Act (40 CFR 1502-14).

PLAN FORMULATION: ALTERNATIVE MEASURES CONSIDERED

Most of the actions considered in this study were derived from measures taken during the emergency response to the eruption of Mount St. Helens. The Corps of Engineers has been able to draw upon field experience in an unprecedented, complex situation. This experience served as a pre-selection process. Of the 13 measures selected for screening, all have either been field tested or derived from actions applied in the study area. In addition, the Corps' wide experience in comparable flood-threat situations served in the determinations of the preliminary screening.

Measures considered for inclusion in plans addressing flood protection and reduction of navigation impacts included the following:

- o Temporary Evacuation: Evacuation of residents from vulnerable areas at times of high threat of flooding.

- o Limited Permanent Evacuation: Permanent evacuation of areas upstream of Longview and Kelso, Washington. Federal, State, or local government would purchase property. Use of the area would be limited thereafter.

- o Land Use Regulations: Zoning restrictions and moratoriums on construction in threatened areas.

- o Seeding and Planting: Seeding and planting of appropriate vegetation in the devastated areas around Mount St. Helens, with fertilization of nutrient-poor sediment.

- o Floodproofing: Alteration of structures to reduce or eliminate damage from flooding; to be fully effective, measure requires maintaining access to structure.

- o Raise Bridges: Raising of Interstate Highway 5 bridges and the Burlington-Northern Railway which span the Toutle River.

- o Raise Cowlitz Levees: Raising of levees along the Cowlitz River in areas of greatest potential flood damage, from Castle Rock to the mouth of the Cowlitz River.

- o Cowlitz Erosion Control: Stabilization of erosion from dredged material disposal areas developed during emergency actions after the major eruption, or from interim work, would be accomplished by resloping and riprapping.

- o Cowlitz Dredging: Dredging all or part of the Cowlitz River between its mouth and confluence of the Toutle River.

- o Channel Constrictions: Placing groups of pilings in a row across the river current; constriction at times of high flow tends to create "ponds" behind the pilings, thus reducing water velocity and promoting deposition of sediment.

- o Sediment Stabilization Basins (SSB): Continued excavation of ponds at areas where the Toutle River naturally flattens; the ponds reduce flow velocity, causing sediment to fall out.

- o Multiple Retention Structures (MRS): Consists of construction of rockfill dams. These structures reduce water velocity; as a result, sediment settles out. High flows pass over a spillway.

- o Single Retention Structure (SRS): Construction of a large retention structure to capture eroding sediment. Floods would pass over a spillway. Construction could be phased, as needed, until all eroded material is stored.

These measures were screened in two steps. In the first screening, the following criteria were applied:

Basic:
1. Provides flood protection
2. Reduces impacts to navigation

Other:
1. Stabilized river banks
2. Maintains water quality
3. Minimized impacts to fish and wildlife

Measures that passed initial screening were subjected to more pointed, specific criteria of a second screening, based on the following questions:

- To what extent does a measure trap sediment in the upper Toutle River Basin? The more sediment that moves into the Cowlitz River, the more problems it creates.
- Does the measure intend to use available, nearby sites for dredged or excavated materials? The farther materials are moved, the higher the cost.
- To what extent does the measure allow for fish migration? The smaller the river blockage, the greater potential for accommodating fish passage.
- Is the measure consistent with current and planned land use? Prime agricultural or other desirable land should not be used for dredged material disposal areas.
- Is the measure compatible with other agency actions and authorities? Does the measure compete with other agency actions and can a potential sponsor participate in implementation?
- How effective is the measure? Is the measure implementable and can the measure be implemented in time to satisfy the planning objectives?
- Is the measure acceptable to the public and the State of Washington as well as local governments?

ALTERNATIVE PLANS

The second screening identified five measures warranting consideration as alternative plans. These alternative plans are discussed briefly below.

Limited Permanent Evacuation

Lands and improvements in the Cowlitz River flood plain upstream of Longview-Kelso would be purchased and allowed to flood as the Cowlitz River filled with sediment. Lexington and part of Castle Rock would be included in the purchase. Some 5,000 people would receive relocation assistance. The flood plain would include the Cowlitz Valley from Longview to Toledo. Additional rights-of-way would be required for levees in Longview and Kelso. Then levees would be raised and set back to accommodate higher river levels. The I-5 and Burlington-Northern bridge and their approaches, would be raised where they cross the Toutle and Coweman Rivers. Extensive dredging would be required on the Columbia River and possibly on the Cowlitz River as well.

Sediment Stabilization Basins

Sediment stabilization basins (SSB) would be located at three sites on the Toutle River where SSB's have been operated before. SSB's are excavated sumps in the river which slow stream currents so that the sediment settles out. This process requires year-round dredging and extensive off-site disposal. Low trapping efficiency during peak flows would require dredging in the Cowlitz and Columbia Rivers.

Multiple Retention Structures with Dredging

Earth and rockfill structures would be constructed across the Toutle River at four sites. These 40-foot-high structures would prevent sediment from passing in all but extreme flood conditions. All four structures would be built concurrently under this management strategy. Material would be dredged from behind these structures on an as-needed basis in order to maintain trapping capacity. Off-site disposal would be required for the large volume of dredged material. Additional dredging would be required in the Cowlitz and Columbia Rivers.

Multiple Retention Structures without Dredging

Structures would be incrementally constructed across the Toutle River at three sites. These 160- to 190-foot-high structures would prevent sediment from passing in all but extreme flood conditions. Structures would be built in sequence with the downstream structure being built first. As sediment was trapped behind the structures, it would not be removed, but spillways would be raised as needed. Downstream measures would be required to deal with the material already in the system below the structure, including dredging on the Cowlitz and Columbia Rivers.

Single Retention Structure

A single retention structure would be constructed to prevent sediment from passing in all but extreme flood conditions. Sediment trapped behind the structure would not be removed. Downstream measures would be required for two years to deal with the material already in the system below the structure, including dredging on the Cowlitz and Columbia Rivers.

Three sites have been identified for location of an SRS: LT-3 located on the main stem Toutle River at approximately River Mile (RM) 9.5 at the mouth of Hollywood Gorge near Tower; Kid Valley located on the North Fork of Toutle River at approximately RM 6.9 near Kid Valley; and Green River, also located on the North Fork of the Toutle River at approximately RM 13.5, just upstream from the mouth of the Green River. Each of these sites has physiographic features ideal for construction of a sediment trap. They are composed of both narrow segments of the river valley, where a structure can be built within rock abutments, and a much wider valley segment upstream, with a broad flood plain area capable of storing large volumes of both sediment and water. The configuration of the single retention structure would differ depending on the location and on whether or not staged construction is used. Generally, the structure would consist of an RCC gravity dam, an ungated overflow spillway discharging into a stilling basin, and an outlet structure to provide flow and water quality control.

NO ACTION

In this alternative, the Federal Government would take no structural or non-structural action to control the deposition of sediment in the lower Toutle and Cowlitz Rivers; however, the 40-foot navigation channel in the Columbia River, an existing Federal project, would be maintained. Sediment transport and deposition in the Toutle and Cowlitz Rivers would continue unchecked, as described in the section "Environmental Effects of Alternatives" of this environmental impact statement.

BASE CONDITION

A base condition has been selected which recognizes the continuing Federal responsibility for flood protection measures much as those implemented periodically since the May 1980 eruption. Continuation of interim flood protection on the lower Cowlitz is authorized by Public Law 98-63, enacted in 1983.

The base condition represents the level of flood protection which existed following the completion of Cowlitz River dredging in December 1983. Using data developed for the sedimentation analysis described in appendix C, quantities of material dredged to maintain the base condition have been estimated. These quantities, listed in appendix D, exhibit 1, amount to 113 mcy over the study period. Dredging would occur at the mouth of the Toutle, in the vicinity of Castle Rock, and on the lower Toutle River. The location of both dredging and disposal would be determined as the need arises. A list of potential disposal sites for future use is contained in appendix D, exhibit 1. Information available at this time is insufficient to clearly define the timing and extent of needed dredging and disposal activities; therefore, a more detailed assessment of the environmental impacts of these actions would be required prior to implementation. Continued dredging of 71 mcy would also be required in the Columbia River to maintain the navigation channel.

NATIONAL ECONOMIC DEVELOPMENT (NED) PLAN (PREFERRED PLAN)

The National Economic Development (NED) plan calls for constructing a single retention structure on the North Fork Toutle River at approximately river mile 13.5, about two miles upstream of the Green River confluence. The structure would be 177 feet above the existing streambed with a spillway height of 155 feet.

COMPARATIVE EFFECTS OF ALTERNATIVE PLANS

PHYSICAL ENVIRONMENT

	Toutle River	Cowlitz River	Columbia River
No Action	651 mcy of material eroding from the debris avalanche will enter the North Fork and main stem Toutle River between 1985 and 2035. Gravel will settle out in the upper North Fork; heavy sedimentation in lower reaches and channel braiding.	Total sediment deposition would be about 78 mcy by 2035.	Deposition in the Columbia would require dredging an additional 145 mcy to maintain the federally-authorized navigation channel.
Base Condition	39 mcy of sediment would be removed from lower Toutle.	Sediment would be removed from lower Cowlitz as needed. Up to 74 mcy would be removed to maintain base level flood protection. Many new disposal sites would be required, at varying distances from river.	Up to 71 mcy would be removed from Columbia navigation channel.
Limited Permanent Evacuation	Same as no action.	Same as no action.	Same as no action.
Sediment Stabilization Basins (SSBs)	Would require extensive disposal areas.	Sedimentation in Cowlitz would be reduced compared to no action.	Sedimentation in Columbia would be reduced compared to no action.
Multiple Retention Structures (MRS) with dredging	Permanent structures would retain sediment in Toutle.	Sediment in Cowlitz would be reduced compared to no action.	Sediment in Columbia would be reduced compared to no action.
MRS without dredging	Sediment would be trapped in the Toutle and permanently retained while passing river flows.	Sedimentation in Cowlitz substantially reduced compared to no action.	Sedimentation in Columbia substantially reduced compared to no action.

COMPARATIVE EFFECTS OF ALTERNATIVE PLANS

PHYSICAL ENVIRONMENT

	Toutle River	Cowlitz River	Columbia River
Single Retention Structure (SRS)	Material eroded from debris avalanche would be retained in Toutle. Material would continue to be carried from sources downstream of the structure for two years. Increase in water temperature could occur (up to 7° to 9°F) due to ponding behind SRS. Downstream effect would diminish rapidly.	Sedimentation in Cowlitz substantially reduced compared to no action.	Sedimentation in Columbia substantially reduced compared to no action.

COMPARATIVE EFFECTS OF ALTERNATIVE PLANS

BIOLOGICAL ENVIRONMENT: FISHERIES

	Toutle River	Cowlitz River	Columbia River
No Action	Continued perturbation of N. Fork and main stem Toutle River for at least 35 years; recovery of fishery habitat estimated to require at least 75 years.	Continued sedimentation and channel braiding could significantly reduce value of this river as a migratory channel for anadromous fish. Sediment would continue to cover spawning areas. High turbidity levels would continue.	Sedimentation in the lower Columbia and estuary would have adverse impacts to fisheries resources. Major dredging activities would cause much turbidity.
Base Condition	High turbidity levels during dredging operations; upper Toutle and tributaries would remain accessible to anadromous fish.	High turbidity and hazards to fish passage during dredging operations.	Increased turbidity during dredging operation; losses of riparian vegetation from disposal.
Limited Permanent Evacuation	Same as no action.	Over the long term, new habitat would be created as the river meandered and formed new channels, backwaters, and oxbows.	Sedimentation would be reduced compared to no action.
Sediment Stabilization Basins	Same as base condition.	Over the long term, new habitat would be created as the river meandered and formed new channels, backwaters, and oxbows.	Sedimentation would be reduced compared to no action. Positive fisheries effects.
MRS with Dredging	Fish passage blocked to most of Toutle River and tributaries. Fish ladders could be installed, but removal of sediment would create additional hazards above structures.	Improved conditions in Cowlitz for fish migration. High turbidity levels during dredging behind MRS.	Reduced sedimentation in the river and estuary compared to no action. Positive fisheries effects.

COMPARATIVE EFFECTS OF ALTERNATIVE PLANS

BIOLOGICAL ENVIRONMENT: FISHERIES

	Toutle River	Cowlitz River	Columbia River
MRS without Dredging	Fish passage blocked to upper Toutle River basin and tributaries.	Improved conditions for fish migration. Both sedimentation and turbidity reduced compared to no action.	Positive benefits to Columbia River fisheries as sediment is retained in Toutle River system.
Single Retention Structure (SRS)	Fish passage blocked above structure; mitigation is possible. Some loss of habitat with sedimentation above the structure. Recovery of downstream channel and habitat would be accelerated, providing fishery benefits.	Improved conditions for fish migration. Both sedimentation and turbidity reduced compared to no action.	Positive benefits to Columbia River fisheries as sediment is retained in Toutle River system.

COMPARATIVE EFFECTS OF ALTERNATIVE PLANS

BIOLOGICAL ENVIRONMENT: WILDLIFE

	Toutle River	Cowlitz River	Columbia River
No Action	Natural recovery of wildlife habitat over long-term.	Slow recovery of riparian habitat.	Major adverse effects to wildlife habitat due to increased dredging and disposal needed to maintain navigation channel.
Base Condition	Riparian and upland areas would be covered with dredged material, eventually revegetating.	Riparian and upland areas would be covered with dredged material, eventually revegetating.	Much less disposal than no action.
Limited Permanent Evacuation	Same as no action.	Similar to no action; increase in wildlife habitat in long term.	Similar to no action.
Sediment Stabilization Basins	Riparian lands would be covered with dredged material eventually revegetating as upland habitat.	Riparian habitat would recover more rapidly than if no action were taken.	Less dredging and disposal would be needed to maintain navigation channel, with less impacts on riparian habitat.
MRS with Dredging	Extensive riparian areas on Toutle would be adversely effected by infill and disposal.	Riparian habitat would recover more rapidly than if no action were taken.	Substantial reduction in need for dredging of navigation channel; reduced effects on riparian lands compared to no action.
MRS without Dredging	Pool areas would be filled, but could eventually become valuable habitat. Recovery of riparian vegetation downstream would be accelerated.	Riparian habitat would recover more rapidly than if no action were taken.	Substantial reduction in need for dredging of navigation channel; reduced effects on riparian lands compared to no action.
Single Retention Structure (SRS)	Establishment of upstream vegetation would be delayed until erosion of debris avalanche stabilizes.	Riparian habitat would recover more rapidly than if no action were taken.	Substantial reduction in need for dredging of navigation channel; reduced effects on riparian lands compared to no action.

COMPARATIVE EFFECTS OF ALTERNATIVE PLANS

HUMAN ENVIRONMENT:	SOCIAL EFFECTS
No Action	Major adverse social effects as sediment infill in Cowlitz River causes increased flooding.
Base Condition	Beneficial effects as flood protection for lower Cowlitz is maintained.
Limited Permanent Evacuation	Some positive effects as threatened property is purchased and residents are relieved of risk of personal and financial losses. Negative effects would result from breaking up of existing communities and social systems as residents seek new locations for homes and businesses.
Sediment Stabilization Basins	Some positive effects as action is taken to deal with sediment.
MRS with Dredging	Beneficial effects as community concerns are relieved by positive action to control sediment.
MRS without Dredging	Beneficial effects as community concerns are relieved by positive action to control sediment.
Single Retention Structure (SRS)	Beneficial effects to community viability as sediment is retained in upper Toutle Valley.

COMPARATIVE EFFECTS OF ALTERNATIVE PLANS

HUMAN ENVIRONMENT:	ECONOMIC EFFECTS
No Action	Loss of economic base and employment opportunities to Cowlitz River flooding. Loss of tax base to local governments.
Base Condition	Beneficial economic effects as physical risks to business are reduced. Increased disposal site needs would reduce income opportunities from affected agricultural lands.
Limited Permanent Evacuation	Same as no action except for Longview-Kelso. Long-term benefits to areas receiving flood protection as physical risks to businesses are reduced.
Sediment Stabilization Basin	Beneficial economic effects as physical risks to businesses are reduced. Some jobs would be created by long-term operation of SSBs. Loss of income from lands used for sediment disposal.
MRS with Dredging	Beneficial economic effects as physical risks are reduced. Some jobs would be created by construction of retention structures and dredging.
MRS without Dredging	Beneficial economic effects as physical risks are reduced. Some jobs created by construction of MRS.
Single Retention Structure (SRS)	Beneficial effects to downstream communities as flood protection is restored. Will require removal of existing residences.

COMPARATIVE EFFECTS OF ALTERNATIVE SRS SITES*

	LT-3	Kid Valley	Green River
Physical Environment	SRS with a height of 107 ft. would retain 21 mcy; would cover approximately 1,030 acres. Downstream action: removal of 98 mcy from Toutle and Cowlitz, 68 mcy from Columbia.	SRS with height of 318 ft. would retain 463 mcy; would cover approximately 7,800 acres. Downstream action: removal of 27 mcy from Toutle and Cowlitz, 15 mcy from Columbia.	SRS with height of 177 ft. would retain 299 mcy; would cover approximately 3,267 acres. Downstream actions: removal of 29 mcy from Toutle and Cowlitz, 15 mcy from Columbia.
Fisheries	Anadromous fish passage to all water upstream blocked, including South and North Fork Toutle and Green River.	Anadromous fish passage blocked to Green and upper North Fork Toutle River.	Anadromous fish passage to upper North Fork Toutle River would be blocked above SRS.
Wildlife	Habitat in pool would be inundated by sediment; vegetation would reestablish over the long term. Downstream dredging would affect large areas of habitat.	Habitat in pool would be inundated by sediment; vegetation would reestablish over the long term. Downstream dredging would affect large areas of habitat. Would affect elk wintering range.	Habitat in pool would be inundated by sediment; vegetation would reestablish over the long term. Downstream dredging would affect some areas of habitat.
Social and Economic Effects	Removal of 13 residences. Portion of County Road and utilities would be inundated. Extensive downstream dredging would require disposal on agricultural lands.	Removal of 34 residences, State Highway 504, a County Road and utilities. Downstream dredging would require disposal on agricultural lands.	Nine residences would be removed. Downstream dredging would require disposal on agricultural lands.

*Several SRS heights were evaluated for each site. The least costly SRS at each site has been used for this comparison.

III. AFFECTED ENVIRONMENT

PHYSICAL ENVIRONMENT

The North Fork Toutle River has its origins on the northwest slopes of Mount St. Helens. Its upper valley contains massive amounts of material from the debris avalanche released by the May 18, 1980 eruption. Downstream of the debris avalanche, The North Fork courses through the material deposited by mudflows to its confluence with the South Fork, forming the Toutle River. As the gradient of the stream bed decreases in the lower valley, sedimentation increases, causing channel infilling, increased channel widths, and bank erosion. At the confluence of the Toutle and Cowlitz Rivers, substantial deposition and bank erosion occurs.

Upstream of the Toutle River confluence (RM 20), the Cowlitz is relatively clean; below the confluence the Cowlitz carries the sediment load delivered by the Toutle. Substantial deposition of sediment occurs in the Cowlitz; the huge mounds of material excavated from the channel and placed on the shorelines near Castle Rock evidence the sedimentation which has continued since the May 18, 1980 eruption. Sediment is also transported by the Cowlitz to the Columbia. These rivers are in a state of transition, seeking an equilibrium following the addition of billions of cubic yards of erodible material into the system by the eruptions of Mount St. Helens.

Other streams, less affected by the eruptions, contribute flows to the system. The major tributaries to the Toutle River are the Green River and the South Fork Toutle River. The May 18 blast affected both of these streams. A mudflow caused erosion and deposition throughout the South Fork Toutle River Valley. The Green River watershed was primarily affected by ashfall produced by the blast. These streams are now relatively clean and contribute only small amounts of suspended sediment to the system. The blast denuded the upper watersheds of these streams and of the North Fork Toutle River valley, affecting their hydrologic characteristics.

The debris avalanche is 17 miles long and over 600 feet deep in some locations. It averages 150 feet deep, tapers down to 10 feet of depth at the toe, and has an overall slope of about 3 percent. The total estimated volume of the avalanche is about 3 billion cubic yards. The material in the avalanche varies in size from silts and clays ("fines"), to sand, gravel, cobbles, and boulders.

The fine material, clays and silts, are easily eroded and transported. These particles move downstream suspended in the flow and are carried into the Columbia River. Few fines are expected to remain in the Toutle-Cowlitz River system. Medium and fine sand-size material is the major source of sedimentation. Sand is transported through the steeper gradient reaches of the North Fork and Toutle Rivers, but as the river gradient becomes less steep and the flow less rapid, the sand particles deposit, particularly in the lower 20 miles of the Cowlitz River.

BIOLOGICAL ENVIRONMENT: FISHERIES

Prior to the eruption, streams in the Cowlitz-Toutle watershed supported anadromous and resident fish populations. Anadromous fish included wild run and hatchery-produced fall and spring chinook, coho salmon, winter and summer steelhead trout, and sea-run cutthroat trout. Hatcheries accounted for the majority of the anadromous fish production in the basin containing the Cowlitz and Toutle River drainages.

The eruption of Mount St. Helens significantly affected the fishery of this area, although the degree of impact varied by tributary. The existing condition is, however, not static but reflects the dynamic condition of a disturbed environment. The fishery, dependent upon the quality and quantity of available habitat, continues to be affected by ongoing sedimentation, while slowly recovering toward the pre-eruptive condition. The Toutle River fishery resource has recovered before, after prior eruptions of Mount St. Helens; and it is expected to recover through time to a condition similar to that of the pre-eruption state. Any description of the current condition of this resource

must, consequently, be viewed as a temporary condition with improvement underway. Estimates of recovery are found in greater detail in the without-project alternative condition. By river system, the following conditions exist.

Toutle River. The present condition of fish habitat in the Toutle River system varies greatly, depending upon the degree of impact caused by the eruption and the extent of continued perturbation. For example, the eruption did not affect Alder Creek (a tributary to the North Fork Toutle above the Green River), and it currently provides productive habitat. At present, these smaller tributaries, such as Alder Creek, provide the major spawning and rearing habitat available in the upper North Fork Toutle. Eventual major production, however, is more closely related to the habitat provided by the larger streams: the North Fork Toutle, South Fork Toutle, and Green River. As described in greater detail in the sediment appendix, the continuing sedimentation and erosional processes affect these major tributaries to varying degrees. It is projected that the North Fork Toutle will continue, as is currently the case, to experience major sediment deposition from the debris avalanche. This impact and associated channel destabilization will prevent the reestablishment of productive fisheries habitat for some time. (Estimates of recovery are found in the No Action Condition, of this chapter). The Green River and South Fork Toutle are not experiencing the habitat-limiting impacts of the North Fork Toutle and are showing "signs" of recovery. However, the lack of riparian vegetation which provides shading to maintain cool waters necessary for production limits fish production. Currently, high stream temperatures, particularly on the Green River, affect production adversely.

The main stem Toutle River continues to experience the effects of habitat-inhibiting sedimentation. This continuing erosion creates a stream where fish must contend with turbidities higher than any stream in America, if not the world; a stream that continuously shifts course and does not allow the reestablishment of mature riparian vegetation; a stream where sediment continues to bury stream gravels. In whole, it is a stream where the continued existence of an anadromous fish run is a tribute to the survival instinct of species. Throughout the Toutle River Basin, eruption-related events affected about 135 miles (77 percent) of the streams used by anadromous fish. This included all of the larger streams, about 101 miles, and 34 miles (46 percent)

of the accessible tributaries. About 62 miles of resident fish habitat were also harmed.

Besides the problems affecting natural anadromous fish production in the basin, hatchery production which adds substantially to overall production from this basin continues lost. Mudflows rendered the Toutle Salmon Hatchery as well as the Deer Creek rearing pond inoperable. Since hatcheries produced approximately 70 percent of the salmon and 60 percent of the steelhead production in this basin, this loss greatly influences eventual production.

Cowlitz River. The Cowlitz River serves primarily as a migratory pathway for anadromous salmon and trout produced in the Toutle and upper Cowlitz systems, although some rearing and spawning habitat existed prior to the eruption. A large spawning run of smelt continues to use this river.

The Cowlitz River below the confluence of the Toutle River remains severely affected by the sediment as the Toutle. Spawning gravels once present are buried under 10 feet of sediment. The sediment delivery to this river reach persists, creating difficult passage conditions. Above the confluence of the Toutle River, the upper Cowlitz is unchanged from the pre-eruptive condition. Pre-eruption anadromous fish hatchery production of the Cowlitz River reach approximated three times that of the Toutle River basin. With the severe damage that has occurred in the Toutle system, the upper Cowlitz fish now make up the majority of anadromous fish population in the basin.

Hatcheries in the upper Cowlitz River provide the majority of this production. These hatcheries compensate for fish losses associated with the Tacoma City Light dams on the upper Cowlitz. They produce fish at or near maximum capacity to provide a Cowlitz River fishery.

Columbia River. The Columbia River is critically important to the region's anadromous fish populations. It is the major migratory corridor for the region and provides important rearing habitat. While the Columbia continues receiving huge amounts of sediment, the impact of this sand and silt on the fishery resource is unclear. It is believed, however, that the higher turbidity and shoaling from this additional sediment does adversely affect the fisheries resource.

BIOLOGICAL ENVIRONMENT: WILDLIFE

Existing vegetation and other factors directly influence the reestablishment of wildlife populations. The eruption resulted in varying impacts to the vegetation and, hence, wildlife populations. Like the fisheries habitat previously described, the status of wildlife habitat is dynamic; recovery is underway.

Toutle River. The eruption severely affected Toutle River wildlife habitat, although the degree of impact varies considerably by area. Mudflows caused loss of riparian vegetation along the lower reaches of the Toutle, while areas nearer the mountain suffered from blast effects which damaged whole forest communities. Currently, channel meandering continues to impede the establishment of riparian vegetation along much of the drainage. Ongoing sedimentation continues to retard recovery within this flood plain corridor. In areas away from this influence, the recovery of wildlife habitat is occurring quite rapidly.

Of interest is the success of elk populations reinvading the upper Toutle River basin. Feeding on early seral-stage vegetation and grass plantings on the lower debris avalanche, these elk have shown a high reproduction rate. However, during a severe winter the lack of winter range in this area may limit the success of these populations.

Cowlitz River. This area previously suffered debasement from the numerous residential and commercial developments along its banks prior to the eruption. Mudflow associated with the eruption further degraded this area and the need for disposal areas during emergency dredging operations also reduced the limited wildlife habitat available. Consequently, Cowlitz River wildlife populations remain low.

Columbia River. The lower Columbia River provides valuable wildlife habitat. The riparian/wetland communities support abundant avian populations including important migratory and wintering waterfowl.

The confluence of the Cowlitz and the Columbia contains the area of greatest concern currently. The need to maintain a sump to protect the Columbia River navigation channel from sedimentation has required a vast disposal area. While initially utilizing areas of lesser wildlife value, the limited area for disposal will soon result in filling valuable wildlife habitat.

HUMAN ENVIRONMENT: SOCIAL AND ECONOMIC SETTING

Population in the study area is concentrated along the lower Cowlitz River, primarily in the incorporated communities of Kelso (11,000), Longview (30,100), and Castle Rock (2,140) (1983 populations), and the unincorporated community of Lexington. Over fifty percent of the population of Cowlitz County lives in Kelso and Longview, on opposite sides of the Cowlitz River.

Land use in Longview consists of valuable high density residential and commercial development within the city limits, with large areas of industrial activity located in the leveed flood plain of the Cowlitz and Columbia rivers. In Kelso, single family residential is the largest land use, with a small amount of land in commercial use. Castle Rock and Lexington land use is mainly residential; the remaining rural flood plain provides areas for agriculture, dredged material disposal, and for a minor amount of industrial activity.

The lower Cowlitz valley is a segment of a major transportation corridor. It contains Interstate Highway 5, the major route for the vehicular traffic between Portland, Oregon, and Seattle, Washington. The Burlington Northern and Union Pacific railroad tracks carry an estimated 22 trains per day, including both freight and AMTRAK passenger trains. These transportation routes are vulnerable to damage by flooding where their bridges cross the Toutle River near its confluence with the Cowlitz.

The economy of Cowlitz County is based on manufacturing industries, with the lumber, wood products, and paper products industries the most important. Retail trade, services, and government are the next largest sectors of the economy. The Kelso-Longview area is the largest center of industrial activity and employment in the County.

Unemployment rates in Cowlitz County have steadily increased since 1974. This trend reflects a loss of jobs in the forest products industries, partly because of cyclical fluctuations in the national home building industry. In recent years, however, timber supply, export competition, shifts in markets, and mechanization have contributed to a structural rather than a cyclical decline in the number of persons employed in the forest products industry. The depressed logging and forest products industries are believed to be the primary reasons for a net out-migration of population from Cowlitz County in the past several years. The after-effects of the eruption of Mount St. Helens and fear of recurring future eruptions may have contributed to the out-migration, but not as much as the absence of jobs.

A primary concern among the residents of the lower Cowlitz valley is the possibility of flooding and the disruptions to personal and financial well-being which could result. The possibility of flooding in this area is considered to be a real threat to life and property. The effects of flooding are well-known to residents of the lower Cowlitz; floods have been a recurring problem since settlement of the valley more than 100 years ago. The Corps of Engineers repaired and improved levees after major flooding in 1933, 1953, and 1956; and local diking districts have responsibility for maintaining them. Prior to the May 18, 1980, eruption of Mount St. Helens, the flood protection along the lower Cowlitz was estimated at the 500-year level. After the eruption and mudflows, the level of protection dropped to a 100-year level and in some cases to levels much lower.

Since the eruption, the potential for flooding has been kept in the public eye through news reports in the media, public meetings in connection with preparation of the Toutle-Cowlitz Watershed Management Plan by Cowlitz County and the Corps of Engineers Comprehensive Plan, and the periodic dredging and sediment removal activities on the lower Cowlitz and Toutle Rivers.

Dredging work since the initial eruption has left huge mounds of dredged material in the lower Cowlitz floodplain, visible reminders of the continuing flow of material eroded from the debris avalanche on Mount St. Helens. The temporary increases in levee heights in some areas created physical barriers and access problem for local residents. Examples are the concrete stoplogs on the

Longview levee across the main entrance to the Hall of Justice, and stoplogs which separate condominiums from their parking garages. While most residents view these features as beneficial in protecting property and lives, some homes are situated between the levee and the river. Cowlitz Gardens, a North Kelso neighborhood, is such an area. Thirty-six residences, located on the river side of the nearby levee, are at risk from flooding.

A flood warning system has been developed to minimize the potential for loss of life in the event of major flooding. If flood warning becomes necessary, the County Sheriff's Office and Department of Emergency Services will use a combination of several elements of the system. Elements of the system include sirens, patrol cars travelling pre-assigned routes with public address systems, and radio and television bulletins. This system is designed to provide warning in remote areas as well as in the urban centers, and the public has been well informed of the warning signals and evacuation routes. Confidence in the effectiveness of this system in protecting lives appears high among residents.

Recreation opportunities associated with the Toutle and Lower Cowlitz Rivers have been greatly diminished by the mudflows, continuing sedimentation, and sediment removal and disposal activities, all resulting from the eruptions of Mount St. Helens. The devastation caused by the volcano, however, has become an attraction for visitors to the area. To provide an opportunity for the public to view the remnants of these volcanic events, State Highway 504 has been reconstructed up the valley of the North Fork Toutle River to the N-1 debris retention structure. Cowlitz County has provided a parking area and visitor information center at that site, with some tourist facilities operated by concessionaires. An estimated 200,000 tourists visited this facility during 1983.

The Forest Service plans to develop a permanent interpretive center 5 miles east of Interstate Highway I-5 on Highway 504 at Seaquest State park. This facility is scheduled for completion in 1985 and will provide a full range of interpretive information. The Forest Service estimates that over 800,000 persons will visit this facility each year. The Forest Service is also developing a Comprehensive plan for management of the Mount St. Helens National

Volcanic Monument (NVM) established by Congress in 1982. Most of the alternative plans being considered include access by State Highway 504 to planned visitor facilities on the west side of the NVM.

HUMAN ENVIRONMENT: CULTURAL RESOURCES

Research on prehistoric Native Americans identified three sites within the study area. Two sites (a village and burial area) are located within 2 miles of the confluence of the Toutle and Cowlitz Rivers. A third site (suggesting implement production) is located in an upland setting in the vicinity of Hollywood Gorge. These archeological sites offer support for the ethnographically identified subsistence pattern of the Salish Cowlitz Indians' use of uplands for hunting and gathering, and the lowlands for village sites. These villages were situated near fishing areas on the Cowlitz River. It is likely that Sahaptin speaking Indians also seasonally exploited areas on the upper Toutle basin (North and South Forks, Spirit Lake and the Mount St. Helens vicinity) with the Salish Cowlitz. Because of the limited cultural resource data for the Toutle drainage, the extent of upland use over time and specific sites are unknown. Consequently, background research into Native American activities in the study area suggests certain uses rather than identifying specific activities and sites.

Hudsons Bay Company trappers exploited the fur resources of the study area, becoming the first Euro-Americans to visit the Toutle basin. Historical sources indicate that settlement of the Toutle basin occurred in the 1880s. Homesteading did not take place before this time because of better agricultural land available along the Cowlitz River. Moreover, the lack of roads limited access to the Kid, Green River, and Toutle valleys. Early maps indicate travel was limited to a broken trail system generally following the ridge lines and main river drainages. Most homesteads contained only 10 to 20 acres under cultivation, small orchards, and the necessary homes and outbuildings. By 1910, all of the land suitable for agricultural purposes had been claimed. Small-scale dairy production or forage and hay crops developed over time as the chief agricultural pursuits. Another important economic activity for the early settlers involved cutting and floating cedar bolts to market. Most of

the early settlers were Swiss, Germans, Scandinavians, and Canadians. Of the original homesteading families along the North Fork of the Toutle, only one has remained in the valley to the present.

Logging first began south of the Toutle River on Ostrander Creek in 1887. Within the study area, the Northern Pacific Railroad had sold most of its land grant timber lands to the Weyerhaeuser Lumber Company in 1900. By the late 1920s, the Weyerhaeuser Company had acquired nearly all of the remaining timber lands in the Toutle Basin. After World War II, the Weyerhaeuser Company developed an extensive rail and logging road system to carry out its operations.

To the east of the study area, mining for gold, silver, copper and sulfur began in the 1890s and continued until World War I. Mining locations included sites near the headwaters of the North Fork Toutle River, and the northeast edge of Spirit Lake, the north and south slopes of Mount St. Helens, and the Green River drainage. The monetary value of the mining claims proved insignificant, as the metal-bearing ore was not present in commercially valuable quantities. However, miners did extract significant amounts of sulfur near the summit of Mount St. Helens until World War II.

PHYSICAL ENVIRONMENT

No Action

Toutle River. Sediment yields from the debris avalanche are expected to remain high throughout the 50-year project life. Ongoing changes occurring in the avalanche wil gradually reduce the rate of erosion, but the Toutle River Basin is expected to remain the most rapidly eroding watershed of its size in the United States.

The processes of bank downcutting and new channel formation contribute sediment to the flow, and existing channels undergo periods of scour and aggradation. Eventually these channels will become lined with cobbles as the finer materials are eroded; this armoring indicates the emergence of stability. Erosion will continue until drainage patterns stabilize.

The timing of sediment movement--how much is transported at a given time--is dependent on the intensity, duration, and timing of storms. The total amount of sediment affects the system in various ways. First, sediment transport varies exponentially, not directly, with increases in water discharge. Thus, streamflows following major storms carry many times the amount of sediment of flows generated by smaller storms. Second, storms often occur in series in the Pacific Northwest. When this happens, the rivers are not able to move sediment delivered by the first storm through the system before the second storm presents an additional volume of sediment. Two storms in 1982, for example, delivered nearly 11 mcy to the lower Cowlitz within four weeks.

In the North Fork Toutle River, the gravel and larger size classes settle out; the steep gradient and greater flow velocity of the stream make it an efficient transporter of sediment, and much of the sand and fine particles delivered to it pass on downstream. Carrying a heavy sediment load, the bed of the Toutle shifts radically; during a single storm, the amount of fill can be measured in tens of feet. Most of the changes in the main stem of the Toutle

have occurred in the lower gradient reaches of the stream. At these locations, considerable deposition has caused braiding, a condition that can double or even triple a river's width. As the river braids and widens, it attacks and erodes its banks.

Cowlitz River. The lower Cowlitz has less capacity for sediment transport than the Toutle; the low gradient and slower flow velocity cause sand-size particles to settle out. As the channel is filled in by sediment, the river will develop a braided pattern as aggradation changes the channel cross section from one of narrow, deep form to a wide, shallow cross section. Braiding occurs as an overloaded stream reach adjusts to pass the sediment carried to it from upstream. Braiding is caused by the formation of bars, dividing the flow into multiple streams which rejoin and subdivide repeatedly.

Deposition in the Cowlitz River would average 5 to 6 mcy per year for the immediate future. This would cause a continual increase in water surface elevations and expose all areas along the lower 20 miles of the Cowlitz River to the threat of annual flooding. The annual rate of deposition would gradually decline as the trapping efficiencies and incoming sediment loads decreased. The total accumulation in 20 years would be about 78 mcy.

Columbia River. Sand discharge from the Cowlitz River will have the potential for depositing in the Columbia River navigation channel in the vicinity of the Cowlitz/Columbia confluence for the entire 50-year study period. Annual deposition rates are projected to range from 6 mcy initially to 2 mcy in 50 years. The problem is expected to be most severe during the first 10 years, when the predicted erosion rates on the avalanche and Toutle River are highest. Deposition in the Columbia would only be a problem during the winter, when Columbia River flows are low and storms in the Toutle River basin produce large volumes of sediment. The Columbia could scour most of the deposition during its spring freshet, but that would be several months too late to prevent disruption of navigation. Additional dredging would be required to maintain the Columbia River navigation channel.

Base Condition

The base condition assumes continued interim dredging in the lower Cowlitz and Toutle Rivers. An estimated 113 mcy would be removed over the 50-year project life. Dredged material would be disposed of at sites in the lower Cowlitz and Toutle Rivers. Sites which have been identified as being suitable for disposal of material are shown in appendix D, exhibit 5 (plates B-1 through B-6). No determination has been made as to the availability of these sites.

An estimated 71 mcy would be removed from the Columbia River navigation channel. Disposal would occur at sites in the vicinity of Columbia River miles 68 to 71. The specific sites have not been selected at this time.

Limited Permanent Evacuation

This alternative would provide for removal of damageable property from the Cowlitz River flood plain above Kelso-Longview and would allow the processes of erosion, sedimentation, and channel stabilization to occur unimpeded. Removal of structures in the flood plain would increase the capacity of the lower Cowlitz to receive sediment deposits. Sedimentation would occur in the Columbia River, requiring extensive dredging to maintain the navigation channel.

Sediment Stabilization Basins

With this alternative, a series of three sediment stabilization basins on the Toutle River and North Fork Toutle River would reduce the amount of sediment moving downstream into the lower Cowlitz and Columbia Rivers. When these basins, or sumps, are excavated in the river, shallow pools form reducing the flow velocity. Sediment settles out in the basin and is then removed to disposal areas by mechanical means, such as dragline, hydraulic dredge, backhoe or scraper.

Once disposal areas adjacent to the SSB's are filled with excavated material, additional deposits would have to be hauled to more distant sites. This would extend the physical impacts of the eruption to lands not otherwise affected.

Because SSB's have limited efficiency, not all sediment would be removed from the system before the Toutle River enters the Cowlitz. Physical limits exist on how much material can be handled by dredging equipment in a given period of time. Moreover, the sediment delivered by one storm might equal or exceed the capacity of the basin. Because storms in this region often occur in series, a second storm could bring another wave of sediment before the basin could be dredged. Even if all three sediment stabilization basins operated continuously, only part of the sediment being transported could be trapped and removed with average flow conditions. Deposition of sediment in the lower Cowlitz and Columbia Rivers could necessitate additional dredging and disposal of material at downstream sites.

Multiple Retention Structures With Dredging

With this alternative, retention structures would be constructed along the Toutle and North Fork Toutle Rivers. Dredging operations behind the structures would remove the sediment to adjacent disposal areas until filled. Cowlitz and Columbia River dredging would also be required. Multiple retention structures with dredging are essentially enhanced sediment stabilization basins. They could retain slightly more material in storage to lengthen the time during which dredging could be performed, and they would be slightly more efficient than SSB's under low and moderate flow conditions. The amount of available onsite disposal area would be reduced somewhat because of the pool behind the retention structures.

Multiple Retention Structures Without Dredging

This alternative proposes a series of retention structures located along the Toutle and North Fork Toutle Rivers that would trap and permanently retain all future material eroded from the debris avalanche. These structures would remain in place once maximum sediment retention had been achieved.

These structures would be designed to pass river flows while capturing sediments. Some ponding of water would occur. Staging of construction is a possibility, particularly at upstream sites. This would allow construction in increments, raising the height of the dam and spillway as sediment fills in behind the structure.

This alternative would permanently alter the topography of the Toutle and North Fork Toutle Rivers. These structures and the sediment captured behind them would create a series of plateaus and waterfalls which would remain permanently in place.

Single Retention Structure

This alternative entails constructing a single retention structure (SRS) on the North Fork Toutle River with enough storage to trap most of the material projected to erode from the debris avalanche. Downstream dredging would be necessary to remove material below the site and sediment passed downstream during construction.

Sediment retained behind the structure would permanently fill in the existing streambed and floodplain of the North Fork Toutle River. High turbidity levels and channel instability would continue for prolonged periods in the sediment impoundment area. Once maximum sediment retention is achieved, channel stability could occur across the plateau of impounded sediment.

Ponding of water would occur behind the retention structure. Streamflows would pass through the outlets, with pools forming from larger storm events. Water temperature increases in these pools would occur, depending on the retention time of the stored water. Significant heating is not expected to occur as long as the retention time is less than 30 days. Surface water released after 30 days would be expected to increase 7° to 9°F above inflow temperatures. Once released, significant heat dissipation will occur because expected turbulent conditions would create a good air/water interface during the daylight hours. Also, night air cooling would increase heat removal from the water. Most of the heat is expected to dissipate during the first 24 hours following the release of the water.

A stilling basin will affect the water quality of the Toutle River downstream of any structure. During the water year's low flow period, July through September, a secondary impoundment would be created by any stilling basin downstream of the structures. If turbidity levels are not a limiting factor, stilling basins will tend to slow down the water velocity and provide a site for increased bacterial and algal productivity. This will not occur if turbidity levels are high and block sunlight needed for growth. The proposed Green River site regulating outlet does not discharge into the stilling basin. The LT-3 and Kid Valley sites do. The Green River stilling basin will probably be a closed system without any purging flows during the summer months. This situation may cause esthetic water quality problems, such as algal blooms visible to observers. Potentially, it could cause public health problems by creating an environment suitable for undesirable bacterial growth. The stilling basins would be flushed by the first major storm of each water year. It is anticipated that after that flushing the bacterial and algal material would no longer be a water quality problem at the debris retaining structures or in the Toutle River.

A secondary impoundment would also be created downstream without any stilling basin. The plunge pool immediately downstream of the debris structure would also act as a mixing tank during the low flow period. This water would tend to provide a site for bacterial and algal production. Flushing would only occur during and following the first major runoff event of the new water year. Other energy dissipation schemes, such as a flip bucket, will not be important factors during significant periods of water quality concern. Low summer and early fall flows will not be affected by a flip bucket.

Downstream of the structure, dredging in the lower Toutle River would continue to be required for two years, decreasing as channel stabilization and revegetation occurred. With the material from the debris avalanche retained in the upper Toutle valley, physical and biological recovery of the lower river would occur at a greatly increased rate compared to no action conditions.

Three sites were identified as suitable for an SRS. The Green River site is located on the North Fork Toutle River upstream of the Green River confluence at approximately RM 13. The Kid Valley site is on the North Fork Toutle River downstream of the Green River confluence at RM 6.9. The LT-3 site is on the Toutle River at approximately RM 9.5.

An SRS at the Green River site would create an impoundment area of 3,267 acres. Up to 299 mcy would be retained over the 50-year project life. The Kid Valley SRS could retain a maximum 463 mcy, covering 7,800 acres. The LT-3 SRS could retain a maximum 147 mcy, covering 1,030 acres.

BIOLOGICAL ENVIRONMENT: FISHERIES

No Action

Toutle River. If no action were taken, fisheries habitat would recover naturally over a long period. The rate of recovery is dependent upon the degree of initial impact, the period of continued disturbance, and other conditions. Recovery would proceed naturally, with no man-made structure blocking fish passage to upstream spawning habitat. Populations of fish following natural recovery would be lower than those before the eruption, since hatchery production accounts for about 70 percent of salmon and 60 percent of steelhead from this basin.

Recovery of fish production in the basin will be highly variable, depending upon the area, and the chronology of recovery remains highly conjectural. The degree of initial impact is an important factor affecting recovery. For example, North Fork Toutle, where the majority of the natural fish production occurs, is seriously affected by the debris avalanche and will take longer to recover than streams which received only ashfall.

The period of continued disturbance will further affect the time necessary for recovery. As described in the sediment section, the North Fork Toutle will be the longest in recovering from sediment movement (35 years). On the other hand, sediment movement from Green River and South Fork is subsiding presently.

Reduction in stream temperatures and establishment of instream cover also affect recovery timing. These factors are related to the recovery of riparian vegetation. For small streams, riparian trees over 12 feet high are needed to provide shading which reduces summer water temperature to tolerable levels. Tree growth rate data for Mount St. Helens mudflows soils indicate 5-6 years would be required for red alder to reach this height. Mudflow areas are recolonizing faster than debris avalanche areas where revegetation has not begun. Instream cover provided by large organic debris, such as trees, are also necessary for complete habitat recovery. Tree growth data indicates that 50- to 75-year-old trees, growing on mudflow soils will be necessary to provide this large organic debris. Larger main stem rivers such as the North Fork Toutle will require trees not available for at least 75-100 years. These growth times would be lengthened by the period of time needed for vegetation to initially reestablish. Outside the National Volcanic Monument, however, projects are currently underway to provide large organic debris to streams.

Based upon these factors, the following events are expected to occur. Streams affected primarily by ashfall, which include many of the small tributary streams, would reach full production within 10 years. While much of the Green River and South Fork already have some production, the reduction of sediment yield and eventual reestablishment of riparian vegetation would bring full recovery within 15 years; State fishery agencies estimate 1987 for the South Fork Toutle and 1992 for the Green River. For the lower North Fork Toutle River, recovery based upon reduced sediment yield is expected within 35 years. For the upper North Fork Toutle River on the debris avalanche, total recovery might not be seen for 75 years. With the no-action alternative, then, we would see a slow and gradual reestablishment of natural production of anadromous fish. An estimate of this recovery above the Green River site is shown in figure IX-1. This figure, based on recovery estimates provided by the resource agencies, shows catch plus escapement of returning adults

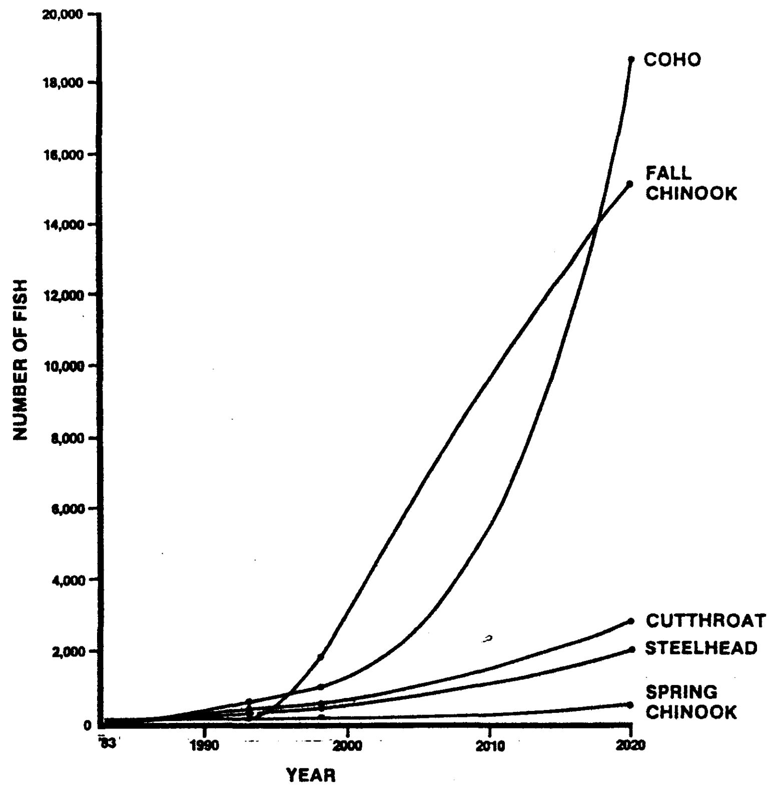


Figure IX-1. Estimated Fish Production Recovery above Green River Site

contributed by natural production above the Green River single retention structure site. This also shows limited natural production currently occurring in the North Fork Toutle River.

Cowlitz. The Cowlitz River would continue to be influenced by continual sedimentation. It would not provide any spawning or rearing habitat and would continue to present turbidity and migration problems until sediment input subsides.

Columbia. While the eventual impact of large quantities of sediment entering the Columbia and estuary remain uncertain, the operations necessary to maintain the Columbia River navigation channel will result in negative fishery impacts. The lack of environmentally sound disposal areas for the millions of yards of dredged sediment will require the use of upland sites that provide

valuable detrital input to the Columbia system, as well as inwater fills in locations that provide valuable fish rearing areas.

Base Condition

Upstream of the sediment stabilization basins, fish habitat recovery would be similar to the no-action alternative. However, continued dredging in the lower Cowlitz and Toutle Rivers could have adverse effects on fish passage by creating additional turbidity and other hazards to fish during migration. The retention of sediment heading for the Columbia would have a beneficial effect on fish in that river.

Limited Permanent Evacuation

Toutle River. The effects of this alternative on fisheries in the Toutle River Basin would be the same as the effects of the without-project condition. No structural measures or dredging would be done in the Toutle River or its tributaries, permitting natural recovery processes to occur. Recovery is related to the time required for the sediment load to diminish and reestablishment of riparian habitat.

Cowlitz River. Under this alternative prolonged turbidity would occur in the Cowlitz River as material from the debris avalanche is eroded and carried downstream with deposition occurring in the abandoned or undeveloped portions of the flood plains of the Cowlitz and Columbia Rivers. This would have detrimental effects to fish migration, spawning, and rearing in the lower Cowlitz River.

Eventually, the rate of erosion and sedimentation would decrease, and water conditions in the lower Cowlitz would improve. Riparian vegetation would reestablish, providing streamside cover and a food source for insects. Over the long term, new habitat would be created for resident fish and rearing salmonids as the Cowlitz River meandered and formed new channels, backwaters, and oxbows in the sediment deposits.

Columbia River. This strategy would have no effect on the long-term sediment yield to the Columbia River. The effects of this approach would be the same as those described for the without-project alternative.

Sediment Stabilization Basins

Toutle River. With SSB's, the upper Toutle River would remain accessible to anadromous fish. During the life of the project, turbidity levels would remain high, especially in the SSB's during sediment removal. This would be detrimental to fish passage, as would the actual removal operations. These effects could be mitigated by scheduling removal activities to avoid periods of major fish migrations, although the quantities that would require dredging might not allow this mitigative action. Since the sites of these SSB's are in the main stem and North Fork Toutle River, fish runs would be affected not only in the North Fork Toutle but also the South Fork Toutle and Green River basins.

There would be continued disturbance to the riparian area and streambed at the three SSB sites during the life of the project. There would also be little or no spawning and juvenile rearing at the SSB sites that extend over large areas.

Cowlitz River. Although the SSB's would reduce sedimentation of the Cowlitz River, dredging would continue to be required in the Cowlitz. Removal operations at the SSB's and dredging in the Cowlitz would contribute to high turbidity levels in the lower Cowlitz during the life of the project. The quantities of sediment requiring dredging would probably not allow a work stoppage during juvenile outmigration. This could impact upper Cowlitz River hatchery releases.

Columbia River. Sedimentation would continue to occur in the Columbia River with the sediment stabilization basins, although in lesser amounts than if no action were taken. This reduced dredging requirement would result in a corresponding reduction in impact to the fishery resource.

Multiple Retention Structures with Dredging

Toutle River. The four structures would block anadromous fish from the Toutle River. Although adults could be transported around the structures, they would be confronted by excavated areas where scrapers and/or draglines were operating. Fish bound for the South Fork would pass over two, and fish bound up the North Fork Toutle would confront four. Fish production would be lost during the operation period. After operation ceases, fish passage problems would continue at each of the structures. Dredged material would also impact fish habitat.

Cowlitz River. Sedimentation in the Cowlitz River would be reduced, improving the conditions for fish migration and expediting recovery. The dredging that would occur behind the retention structures would result in increased turbidity levels entering the Cowlitz. In addition, dredging in the Cowlitz would be required.

Columbia River. This alternative would substantially reduce the amount of bedload material entering the Columbia, resulting in less sediment deposition in the aquatic habitat. Additional dredging, however, would be required to maintain the 40-foot navigation channel.

Multiple Retention Structures without Dredging

Toutle River. Under this alternative, three debris retention structures would block anadromous runs of salmonids in the Toutle River. Sediment back-up behind these dams would inundate several tributaries and extensive reaches of the main stem and North Fork Toutle.

Cowlitz River. Dredging would continue in the Cowlitz River for several more years.

Columbia River. Fisheries in the Columbia would benefit from this alternative, as almost all sediment is retained in the Toutle River system.

Single Retention Structure

Toutle. The construction of a single retention structure at the Green River relocation will have the following major impacts on the Toutle River fisheries resource:

1. Blockage of fish movement
2. Inundation of spawning and rearing habitat, and
3. Downstream impacts.

A structure of this nature would totally block all upstream and downstream migration of anadromous fish if fish passage facilities were not incorporated into the design of this structure. Fish passage facilities are proposed (see proposed fishery bypass, chapter V). Providing these facilities would allow the continuing reestablishment of anadromous fish runs into tributaries above the SRS.

The backup of sediment behind the structure will inundate the streambed with sediment. For the North Fork Toutle, this inundation would not be significant since this stream is already subjected to sedimentation from the debris avalanche. However, the height of sediment backup will also affect tributaries that were not significantly affected by the eruption. Alder Creek, which currently provides productive spawning and rearing areas, will be inundated for four miles of its length.

The blockage of downstream sediment movement with this structure will result in rapid recovery of fish habitat below the structure; improved conditions will develop on approximately 17 miles of main stem Toutle River and 13.2 miles of North Fork Toutle River. Without additional sediment delivery, the sediment in the stream below the structure will erode and allow the reestablishment of a gravel bottomed stream with riparian vegetation supporting fishlife. This optimistic forecast of downstream recovery should be tempered, depending upon the quality of water released from the impoundment. As discussed in appendix D, the potential exists for impounded water to warm to such an extent that when released, its temperature would be detrimental to fish survival. However, with the minimum water impoundment

proposed, it is not anticipated that outflow water temperatures will be significantly different than inflow temperatures. Initial downstream dredging is also proposed as part of this plan. This operation would, however, be greatly reduced under the SRS alternative.

Since the Kid Valley site is below the confluence of the Green River and the North Fork Toutle, an SRS at this site would block valuable anadromous fish production on both streams. In addition, sediment backup from this site would inundate the Toutle River Salmon Hatchery, currently inoperable. The LT-3 site would affect an even greater extent of the Toutle River anadromous fish run, since almost all of the Toutle River Basin productive tributaries are above this location.

Cowlitz. The major factor affecting fish habitat in the Cowlitz River is the continuing sedimentation. This alternative, by reducing the amount of material delivered to the Cowlitz, would result in accelerated recovery for this stream from its mouth to the confluence with the Toutle, approximately 20 miles of stream.

Columbia. The great reduction of sediment entering the Columbia would reduce dredging operations and their impact upon the fishery resource. Filling of productive rearing habitat would not be required to meet disposal needs as might be necessary under the no-action alternative. Overall, this alternative would be very beneficial.

BIOLOGICAL ENVIRONMENT: WILDLIFE

No Action

To describe wildlife impacts simply and succinctly, requires focusing on wildlife habitat. The major component of habitat influenced by sedimentation and the alternatives under consideration is vegetation. By understanding how natural revegetation is impinged or what existing vegetation communities will be affected, wildlife impacts can be discerned.

Toutle. Wildlife habitat devastated by the eruption and debris avalanche is slowly recovering through natural revegetation to its pre-eruption state. The ability of vegetation to reestablish in the impact areas varies considerably from site to site. Simply, sites not impacted by the debris avalanche will recover rapidly, while debris avalanche deposits will recover slowly over a very long period. (This recovery scenario is described in greater detail in the Mount St. Helens Land Management Plan, USFS 1981.)

Relating the differing vegetation recovery rates and the value of differing plant succession to wildlife is a very complex analysis and found in some detail in the Coordination Act Report in exhibit 1, main report. Simply stated, however, the principal factor affecting Toutle River wildlife under the no-action alternative is the impact of sedimentation in retarding the recovery of riparian zone vegetation.

The on-going deposition of sediment in the Toutle River results in a continual meandering of this stream within the flood plain. This meandering results in the loss of the reestablishing riparian vegetation. The no action alternative would result in a long-term instability of the riparian zone of the North Fork Toutle and Toutle River.

Cowlitz. The recovery of riparian habitat along the river would be slow until sediment delivery is reduced to allow the river to stabilize.

While human habitation along the Cowlitz River has reduced the value of adjacent wildlife habitat, the remaining habitat available along this river would be greatly reduced with this alternative.

Columbia. To maintain and protect the Columbia River navigation channel has required dredging at the Cowlitz River sump. With this alternative, dredging would continue over a very long period, requiring large acreages for dredged material disposal. The lack of environmentally acceptable disposal sites at the mouth of the Cowlitz will require the use of areas of high wildlife value, wildlife losses associated with the loss of riparian and wetland habitats with this alternative would be significant. Losses of valuable wildlife habitat would total hundreds of acres under the no-action alternative. Figure IX-2 shows an example of one site where wildlife habitat would be lost.

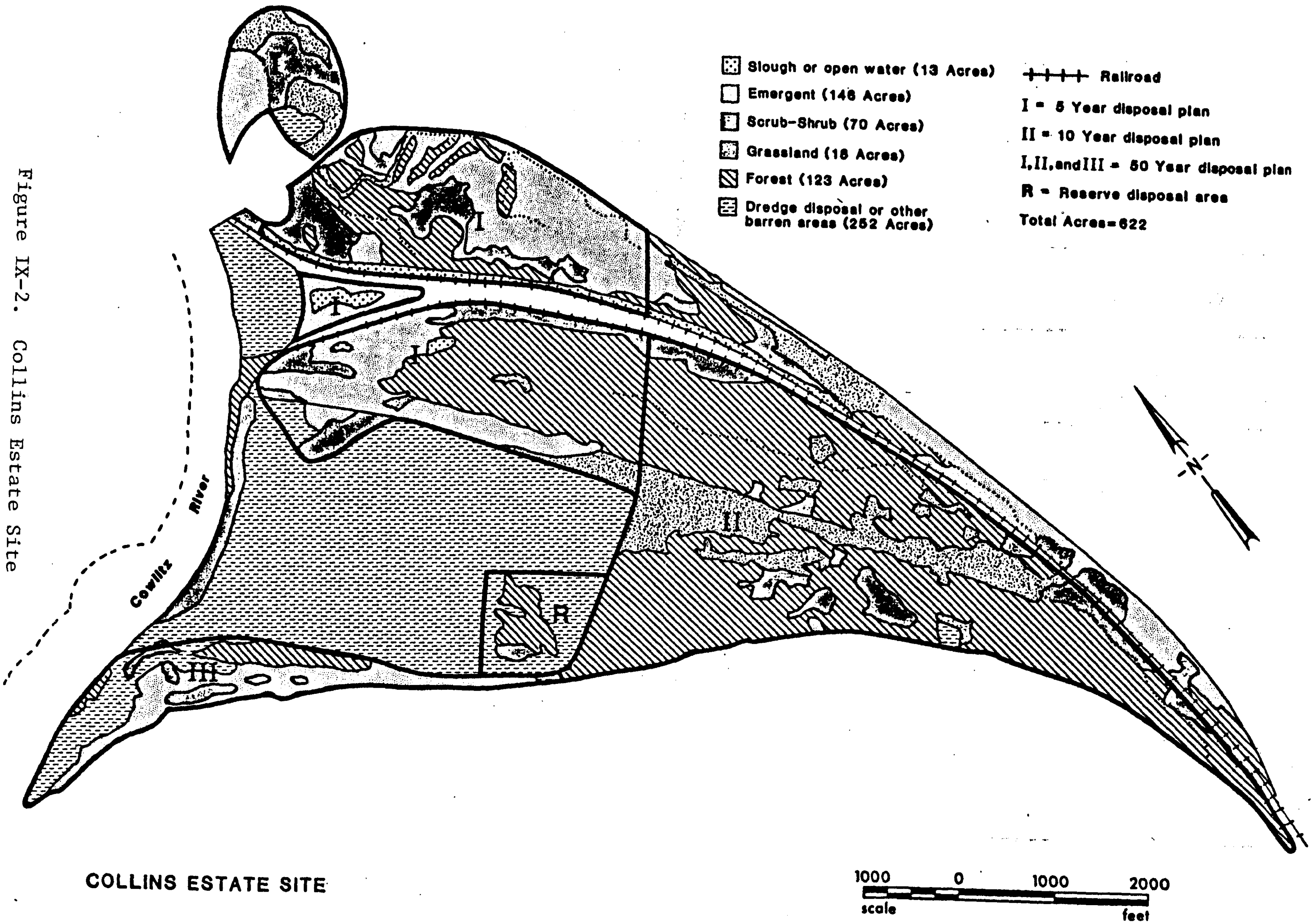


Figure IX-2. Collins Estate Site

Base Condition

Toutle River. The extensive base condition dredging at LT-1 and LT-3 on the Toutle and disposal of material would adversely affect riparian and upland wildlife habitat at disposal sites. New sites would be typically flat, open areas, many currently used for agricultural purposes. Habitat values at these sites would be lost until disposal is completed and revegetation occurs.

Cowlitz River. With this alternative, considerable and long-term dredging of the Cowlitz to maintain 100-year flood protection would be required. Disposal sites along the Cowlitz to adequately handle this material are in limited supply. Disposal would consequently be placed on areas of wildlife habitat and stockpiled at high elevations. As a result, the future value of these areas for wildlife will be very limited.

Columbia River. The reduced sediment load in the Columbia would require less dredging and less need for upland disposal sites harmful to wildlife habitats.

Limited Permanent Evacuation

Toutle River. This would result in a similar situation to the without-project alternative. Recovery of the flood plain would occur but would be impeded by continued sedimentation and river meandering.

Cowlitz River. There would be reductions in the numbers of nongame wildlife, furbearers, upland game, and waterfowl, as sediment is deposited in the lower Cowlitz flood plain. Riparian vegetation, wildlife habitat and populations would reestablish in the long-term as sedimentation decreased and the river channel stabilized. Since this alternative would result in the reduction of human development in the flood plain, the overall impact of this alternative is beneficial.

Columbia River. This alternative could have severe impacts to wildlife along the Columbia River flood plain. There would be drastic reductions in the numbers of nongame wildlife, furbearers, upland game, and waterfowl, as dredge spoils reduced wetlands/marshes and elevated lands.

Sediment Stabilization Basins

Toutle River. The SSB's would result in long-term negative impacts to Toutle River wildlife. The disposal associated with this alternative would require thousands of acres. Significant amounts of riparian and wetland wildlife habitat would be reduced to dredged material sites. Although these dredged disposal sites would eventually revegetate, valuable riparian would be replaced by less valuable upland habitat.

Disturbance of wildlife would also occur during the dredging and spoil disposal operations.

Cowlitz River. This alternative would reduce the amount of sediment entering the Cowlitz River, although sediment would still need to be dredged requiring disposal on several hundred acres of shorelands. Riparian habitat would eventually reestablish as stabilization of the Cowlitz River channel occurs.

Columbia River. The SSB's would reduce the quantity of material to be dredged from the Columbia and the wildlife-related impacts associated with disposal. Although maintenance dredging of the Columbia River navigation channel would continue, the lower quantities associated with this alternative would allow disposal of most material in the Longview-Kelso-Rainier area.

Multiple Retention Structures with Dredging

Toutle River. The multiple retention structures would impact extensive riparian areas along the main stem and North Fork Toutle. Once operation ceases and the pools become stabilized, these areas would then develop into flood plain habitat with the exception of spoil areas which would become upland habitat.

Cowlitz River. Dredging in the Cowlitz would require the disposal of up to 81 mcy of material on several hundred acres of shorelands. This would allow the Cowlitz River channel to stabilize, and riparian habitat would reestablish sooner than if no action were taken.

Columbia River. This alternative would reduce Columbia River sedimentation, thereby minimizing material disposal that would impact wildlife habitat.

Multiple Retention Structures without Dredging

In the short term, an MRS without dredging would severely impact substantial areas of the Toutle River flood plain. In the longer term, however, these areas presumably would return to a marsh/riparian state and retain at least their former value as wildlife habitat. Minimal dredging in the Cowlitz and Columbia Rivers would be required.

Single Retention Structure

Toutle. The major affect upon wildlife of this alternative is the sediment inundation of wildlife habitat behind a single structure. For the Green River site, the sediment inundation area of 3,267 acres, by habitat type, is shown in figure IX-3. The major change would occur in types other than barren or disturbed revegetated; these two types, which comprise approximately half the area that would be inundated, would experience continued perturbation from sedimentation with or without the project. Once the fill of sediment behind the structure subsides, the area is expected to return to a marsh/riparian habitat.

Downstream from the structure, the reduction in sediment would allow the recovery of riparian habitat unaffected by continuous channel change. This area, figuring the area in the Toutle River flood plain yearly inundated, is approximately 1,770 acres.

The Kid Valley site would inundate approximately 7,800 acres of wildlife habitat. In addition, significantly greater areas would be affected by downstream actions associated with this plan.

The LT-3 site would inundate approximately 1,030 acres of habitat. However, the volume of material requiring disposal under this alternative is approximately four times that associated with the Green River site. This location would not allow the accelerated recovery of riparian vegetation in the Toutle River associated with the other two sites.

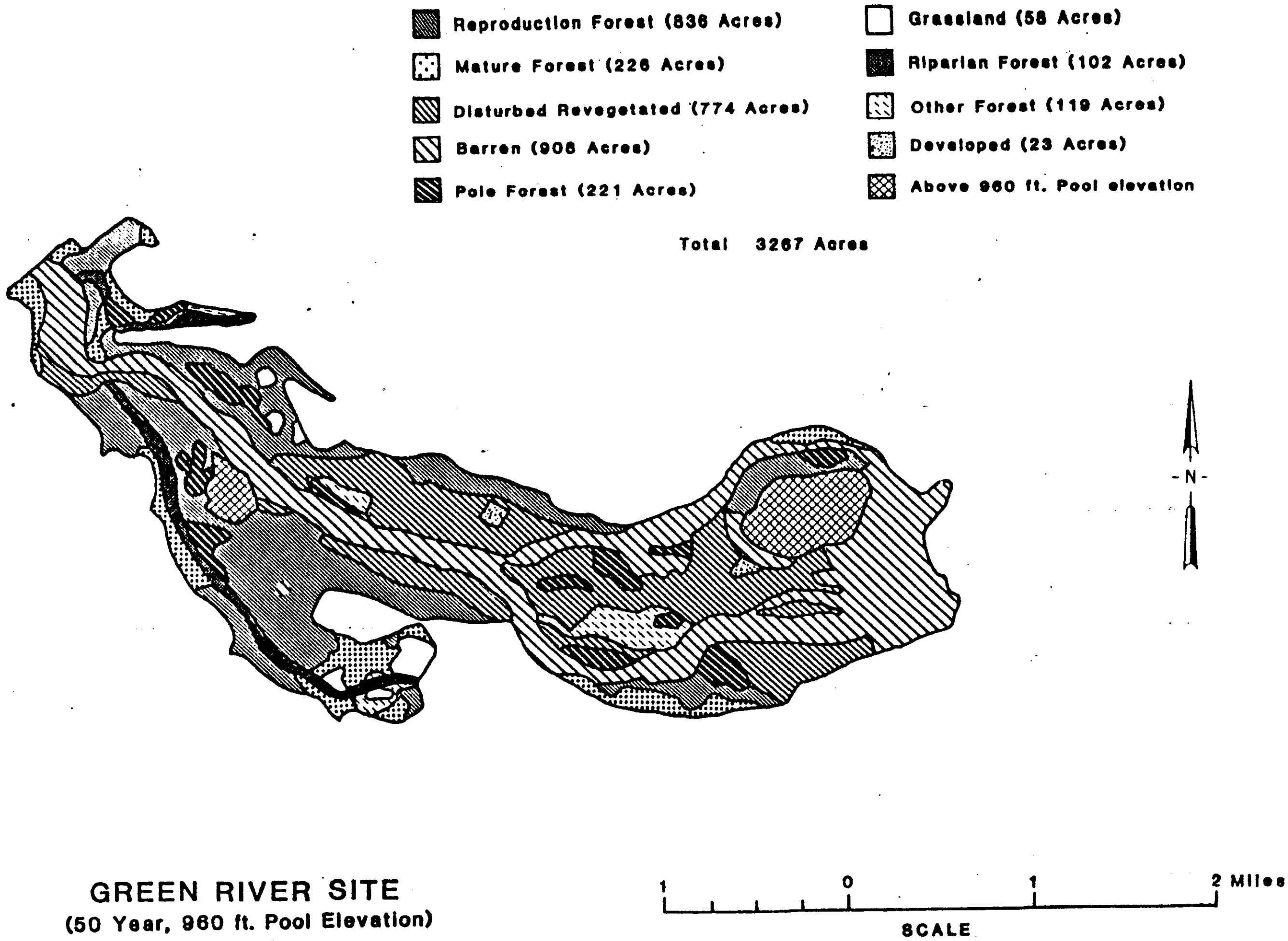


Figure IX-3. Inundation Area of Green River Site

Cowlitz. The reduction of sediment infill and dredging would be beneficial to Cowlitz River wildlife. The reduction in sediment delivery would allow the Cowlitz channel to stabilize and riparian habitat would reestablish sooner than if no action were taken. The reduction in dredging would also reduce the amount of wildlife habitat affected by dredged material disposal.

Columbia. The reduction of sediment would be beneficial in reducing wildlife impacts to the Columbia. The major disposal problem at the mouth of the Cowlitz with dredging of the sump would be reduced in extent; rather than needing to fill large disposal areas shown in figure IX-2, disposal would be limited to 15 mcy.

HUMAN ENVIRONMENT: SOCIAL AND ECONOMIC EFFECTS

No Action Alternative

If no action were taken to control the sediment inflow into the lower Cowlitz, no improvement could be expected in economic and social conditions in Cowlitz County. The level of flood protection for communities in the lower Cowlitz valley would continue to deteriorate as the river channel fills in with sediment. Floodwaters would eventually overtop the levees on a recurring basis; residents and businesses would be forced to abandon the flood plain.

Flooding in the industrial areas on the lower Cowlitz could disrupt the local economy, causing losses to manufacturing facilities and losses of jobs and income. Port facilities would also be damaged, further reducing local income and employment. Transportation in the area would be disrupted with major damage expected to the I-5 freeway and the Burlington-Northern railroad tracks.

The forest products industry in Cowlitz County would be adversely affected. Although access to forests for harvesting would still be possible, markets for logs on the lower Cowlitz would be lost. Lumber mills, paper product manufacturers, ports for transshipment, and related industries are all located on the Cowlitz delta. These industries would not be able to operate at their present locations because the area would eventually be flooded if no action were taken. As business relocated to other regions, the tax base would decline.

Population would be expected to decrease, as persons displaced by flooding look for homes in other areas. Increased unemployment due to flooding of industrial facilities would cause residents to look for opportunities in other locations.

Psychological stress experienced by residents would increase as the effects of flooding, feared for so long, become reality. Emergency relief services would be burdened with providing emergency food, shelter and medical care to persons displaced by floodwaters. Community viability would deteriorate as homes and business are lost to flooding, transportation systems are disrupted, and people leave the area.

Water supply, sewer, and utility systems would be damaged or destroyed, adversely affecting homes and businesses which might otherwise be safe from the direct effects of floods. Prolonged flooding combined with the breakdown of these basic distribution systems could cause severe problems to widespread areas of the lower Cowlitz valley.

Public school systems in the lower Cowlitz flood plain would be faced with the continual flooding and eventual evacuation of many structures, such as Castle Rock High School. Enrollment in Kelso, Longview, and Castle Rock school districts would be expected to drop dramatically.

Base Condition

The base condition would provide a reasonable level of flood protection to the lower Cowlitz valley. Community viability would be strengthened as concerns over the continuing flood threat diminished. The use of agricultural lands for disposal sites would reduce income opportunities from those lands, but economic opportunities in general would be expected to improve. The main impact of large disposal areas would be on tax base and land use, although new employment opportunities would occur.

Limited Permanent Evacuation

The viability of the communities in the evacuated area would be adversely affected. People would be required to abandon their homes in an area inhabited for more than 100 years. Castle Rock would be especially hard-hit; for it is an old, close-knit community. In addition, severe psychological and social stress often occur with displacement and relocation.

Community viability would also be threatened in the protected areas of Kelso-Longview. Restructuring the levees would require large land areas, and relocation of residences and businesses. Some of the more important industrial facilities would be affected by the levee raising, and might be forced to relocate if their access to the river were restricted or if their

activities were limited by a reduced land area. Loss of employment opportunities would adversely affect the economic and social well-being of Kelso-Longview.

Businesses in Castle Rock and Lexington would be severely disrupted or permanently closed during the relocation process. Jobs and income would be lost if businesses were to close rather than move. Some jobs might be created by activities associated with the evacuation, including new home construction, removal of abandoned houses and buildings from the flood plain, levee raising, and highway and railroad relocation.

Revenues to local governments would be reduced as homes and businesses were removed from the tax rolls.

Sediment Stabilization Basins

With this alternative, business and industry would be able to resume pre-eruption activities, making investments and growing as normal business factors permit. Growth in income opportunities would be expected. The long-term need to continuously remove sediment from the stabilization basins and to transport it to suitable disposal sites would generate some jobs. The use of agricultural or forest lands for sediment disposal sites would reduce income opportunities from those lands.

Community viability in the lower Cowlitz floodplain would benefit with this alternative because the threat of flood damages would be reduced. People would be more willing to remain in their existing homes and new businesses would be more likely to locate in the area.

Multiple Retention Structures with Dredging

This alternative would be beneficial to business and income opportunities by restoring flood protection to the area. The long-term need to remove sediment, and the phased construction of the retention structures would generate some jobs.

Multiple Retention Structures Without Dredging

Economic and social effects of this alternative are similar to those for the previous alternative, except that less labor would be required without the need for dredging. Thus, fewer jobs and income opportunities would be generated as a direct result of implementing this alternative.

Single Retention Structure

As described for the other structural alternatives, the flood protection provided by this alternative would help to restore favorable conditions in downstream communities, allowing business and commercial activities to proceed as normal business factors permit. Some jobs would be generated by construction of this alternative.

LT-3. An SRS at this site would require the removal of 13 homes or buildings along Tower Road. A portion of the Tower Road loop off of State Highway 504 would be inundated. Because residences would be removed, there would be no need to relocate the road or utilities. Downstream dredging would require use of agricultural and other lands for disposal. This alternative SRS would require the greatest amount of dredging of the three SRS sites.

Kid Valley. An SRS at this site would inundate residences, a state highway, a county road, the Green River fish hatchery, and utilities. SRS of various sizes would inundate the communities of Kid Valley and St. Helens. The smaller SRS would inundate State Highway 504, the county road for the community of Kid Valley, and power and telephone utilities. Up to 34 homes or buildings would require removal. Downstream dredging would require use of agricultural and other lands for disposal.

Green River. An SRS at this site would inundate the community of St. Helens, as well as the state highway, county road, and utilities. Nine homes or buildings would require removal. Downstream dredging would require use of agricultural and other lands for disposal. Disposal requirements would be approximately the same as for Kid Valley SRS alternative.

HUMAN ENVIRONMENT: CULTURAL RESOURCES

A cultural resource survey of the Green River single retention structure project area has been conducted. The survey did not result in the documentation of any significant historic or archeological sites. Commercial logging practices have obliterated the remains of the first homesteads, such as structures, cleared fields and orchards. Only oral tradition indicates the sites of early homesteads, schools, cemeteries, and post offices located in timbered areas. Isolated historic artifacts are present in the project area. These include square nails, a few fragments of early 20th century bottle glass, and a fireplace with chimney (a remnant of St. Helens post office and stage coach stop). Short-term homestead occupancy, repeated clearcut logging and slash treatment, and the effects of the Mount St. Helens mudflow account for the lack of substantial cultural resources. Results of the cultural resource investigation will be coordinated with the Washington State Historic Preservation office.

Cultural resource surveys of other alternatives have not been accomplished. If another alternative is selected, further investigation would be completed.

V. REVIEW AND CONSULTATION REQUIREMENTS

PUBLIC INVOLVEMENT

The Corps initiated public involvement by publication of a "Notice of Intent to Prepare an Environmental Impact Statement" in the 22 September 1982 Federal Register. In addition, a letter dated 12 September 1982 was sent to approximately 500 agencies, organizations, and individuals informing the public that an EIS would be prepared for the Comprehensive Plan. Both of these notices included a preliminary list of alternatives for the Comprehensive Plan. The letter also identified categories of environmental effects and asked for comments on significant issues to be addressed in the EIS. Comments received were used in developing the scope of the EIS.

These scoping notices stated that an EIS would be prepared as part of the Comprehensive Plan report. The Corps subsequently deferred preparation of the EIS when it determined that the findings of the Comprehensive Plan study should receive a more detailed analysis in a feasibility report.

The Comprehensive Plan report, released for public review in November 1983, described the five strategies for sediment control:

- o Limited Permanent Evacuation
- o Sediment Stabilization Basins
- o Multiple Retention Structures with Dredging
- o Multiple Retention Structures without Dredging
- o Single Retention Structure

During the months of November and December 1983, numerous meetings were held in the study area to present those strategies to the public. The public reaction to the strategies ranged from a preference for continuation of the current dredging program to recommendations for construction of a single retention structure on the Toutle River. The public sentiment expressed most often was to retain the material in the Toutle River. A large majority supported the single retention structure on the Toutle above its confluence with

the Green River. The exception was those people from the Toutle Valley generally opposed to any dams on the Toutle River.

The Governors of the states of Washington, Oregon, and Idaho, and the Community Consensus Position (which was signed by 39 representatives of local government, service and civic organizations) also expressed support for the single retention structure. The U.S. Fish and Wildlife Service also supports this strategy with provisions for fish passage. The U.S. Geological Survey indicated a preference to control sediment as close to its source as possible to minimize impacts of downstream sediment transport and stated a concern that a large increment of storage (100 mcy) should be provided on any structure as early as possible to accommodate the possibility of a major event.

Coordination with other government agencies, Federal, state and local, has been continuous since the initiation of the Comprehensive Plan study. Interagency meetings have been held at key points in the study to present findings and to receive comments. More frequent informal communication among staff members and management of concerned agencies has been an important aspect of this planning effort.

Copies of the Draft EIS were filed with the U.S. Environmental Protection Agency. Notice of filing was published in the Federal Register on 2 November 1984, beginning the 45-day public review period which ended on 17 December 1984. Copies of the EIS were sent to interested Federal, State, and local agencies, private organizations, and members of the public. Copies were also sent to local libraries. A Notice of Availability was prepared to inform the public that an EIS had been prepared, how to obtain a copy, and the beginning and ending dates of the review period. This notice was sent to a wide mailing list, and a press release was prepared for media use. A Public Meeting was held on 29 November 1984 in Longview, Washington to summarize the results of the Feasibility Study and EIS and to obtain the views of the public. A transcript of that meeting has been prepared and is available from the Portland District.

Copies of all written comments received during the 45-day review period, and our responses to those comments, are included in this report (Exhibit 2, Public Views and Responses). The majority of those comments were from local

governments and agencies and members of the public expressing support for the preferred plan and opposition to the proposal that state and local governments be required to share in the cost of implementation of that plan. Comments received from resource agencies, including Environmental Protection Agency, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and Washington Departments of Fisheries and Game included comments addressing specific effects of fish and wildlife resources, mitigation for project effects on these resources, and sedimentation and water quality effects. All of the comments received have been considered in preparing the Final EIS.

Copies of this Final EIS have been filed with the U.S. Environmental Protection Agency, and are being sent to other interested Federal, State, and local agencies, private organizations, and members of the public. Copies have also been provided to local libraries. Comments on this Final EIS must be received within 30 days of announcement in the Federal Register that the document has been filed with the Environmental Protection Agency.

This Final EIS includes a Section 404 Water Quality Evaluation. The evaluation addresses the effects of in-water fills associated with the construction of the preferred alternative.

COMPLIANCE WITH ENVIRONMENTAL LAWS AND EXECUTIVE ORDERS

1. Clean Water Act of 1977. A water quality evaluation, as required by Section 404 (b)(1) of the Clean Water Act, has been prepared for the preferred alternative. This evaluation was included with the Draft EIS for public review and comment. Compliance with the Clean Water Act will be accomplished through the provisions of Section 404(r) of the Act.

2. Coastal Zone Management Act of 1973, as amended. Not applicable.

3. Endangered Species Act of 1973, as amended. The U.S. Fish and Wildlife Service has been consulted and a preliminary determination has been made that no threatened or endangered species would be adversely affected (see exhibit 1).

4. Fish and Wildlife Coordination Act. Fish and Wildlife Coordination Act Report has been received and is hereby incorporated by reference in the Environmental Impact Statement, see exhibit 1. This report has been coordinated with other Federal and State resource agencies.

5. Marine Protection, Research and Sanctuaries Act of 1972, as amended. Not applicable.

6. Cultural Resources. A cultural resources investigation of the project site for the preferred alternative has been completed. No significant cultural resource sites were identified within the project area; therefore no adverse effects to cultural resources are anticipated from the proposed project. Coordination of these findings with the State Historic Preservation Officer has been completed and concurrence received.

7. Executive Order 11988, Floodplain Management. The flood plain has been severely altered as a result of events following the 18 May 1980 eruption. Mudflows, continuing sediment deposition, dredging, and dredged material disposal have all combined to change the topography of the flood plain. These changes will continue to occur for decades if no action is taken to restrict sediment flows. Implementation of any of the alternative plans except the no action alternative would help to stabilize hydraulic conditions in the Cowlitz and Toutle Rivers and allow local authorities to develop plans to manage future use of the flood plains. At the present time, a building moratorium is in effect for the 500-year flood plain of the Cowlitz and Toutle Rivers.

8. Executive Order 11990, Protection of Wetlands. If no action is taken, continued transport and deposition of sediment will have severe impacts on wetlands in the lower Cowlitz and Columbia Rivers. Wetland areas would be filled both by natural deposition of sediment and by placement of material as river channels are dredged.

The impacts of the alternative plans are discussed in the Environmental Effects section of this EIS.

List of Preparers

Name	Discipline/Expertise	Experience	Role in Preparing EIS
David Kurkoski	Geography, Environmental Planning	Environmental Impact Assessment (6 years)	EIS Coordinator
Al Ramirez	Civil Engineering Water Resources Planning	Water Resources Planning (8 years)	Study Manager
Chuck Mason	Planning	Water Resources Planning (15 years)	Asst. Study Manager Plan Formulation
Robert E. Willis	Biology	Riparian Ecosystem Research, Wildlife Mitigation Planning (7 years)	Biological Effects
James Graham	Hydrology, Geology	Sediment Transport Studies (2 years)	Sediment Studies
Joseph Hise	Economics	Regional Economic Studies (11 years)	Economic Effects
Michael A. Martin	Archeology	Archeology (5 years)	Cultural Resources Studies
William F. Willingham	History	History (14 years)	Cultural Resources Studies

SECTION 404(b) EVALUATION
TOUTLE RIVER SEDIMENT RETENTION STRUCTURE
COWLITZ COUNTY, WASHINGTON

Introduction

Section 404 of the Clean Water Act requires that all civil works projects involving the discharge of fill material into waters of the United States be evaluated for water quality effects prior to making the discharge. This evaluation assesses the effects of the discharge described below using guidelines established by the Environmental Protection Agency under the authority of Section 404(b)(1) of the Act.

I. Project Description.

The proposed action is to construct a single retention structure on the North Fork of the Toutle River at approximately river mile 13.5. The site is two miles upstream of the Green River confluence.

II. Description of Section 404 Discharges

a. Single Retention Structure. The single retention structure would be a roller compacted concrete (RCC) gravity dam, with an ungated overflow spillway discharging into a stilling basin and multilevel intakes to provide flow and water quality control. The dam would be 177 feet above the existing streambed with a spillway height of 155 feet. The structure and sediment impoundment area would cover approximately 3,267 acres, and would be capable of retaining 299 mcy of sediment during the 50-year project life.

b. Diversion Dams. Upstream and downstream diversion dams would be constructed to direct river flows to the left side of the existing channel while construction of the RCC foundation and spillway complex are begun.

c. Bank Protection. Bank or shore protection would be provided at the project as needed to control erosion caused by either releases downstream or

wave action within the reservoir. Streambank protection would be necessary only at critical locations where potential erosion might affect a structural component.

d. Fish Collection System. A fish collection system is proposed which would include a water supply system, holding pond, and a fish ladder or trap. Although the specific details of the collection facility have not been defined, coordination with fisheries agencies indicates that some form of collection system would be desirable to collect returning adult salmon and steelhead.

e. Other Construction-Related Fills. As construction progresses, it is likely that other fills would be necessary for construction purposes such as haul road and bridge construction, culvert placement, bank stabilization, and stream diversions for access to borrow areas. Although specific locations and quantities of these construction-related fills are not known at this time, these are typical actions required in the process of constructing a major dam and reservoir project.

III. Physical Determinations

a. Physical Substrate Determinations. The proposed construction site is overlain by recent alluvium and mudflow debris from the 1980 Mount St. Helens eruption up to depths of 20 feet or more. Beneath these, deep glacial fill deposits overlie basaltic bedrock. These sediments consist of hard, subrounded to rounded gravels, cobbles and boulders with sand and some silt. The glacial deposits at the site are estimated to reach a maximum depth of 155 feet and average about 90 feet in depth across the 850-foot-wide site. These materials would be excavated to expose foundation rock at the sediment retention structure site.

b. Water Circulation, Fluctuation, and Salinity Determinations. River flows would be diverted during construction of the retention structure. As an example, one feasible plan for diversion would be accomplished in three stages:

1. Diversion to the left side of the existing channel while the RCC foundation and spillway complex are begun. The minimum diverted stream width would be 30 feet.

2. Diversion through three 12-foot-diameter steel pipes embedded within the RCC foundation. An upstream diversion channel with cofferdam would provide a water surface with a maximum of 40 feet of head on the multiple pipe.

3. Diversion through the completed regulating outlet complex along the left side of the spillway. The retention structure would have ungated multiple regulating outlets (RO). The RO's would be designed to pass flows for a 100-year event.

Once the retention structure is completed, the sediment deposit would begin forming at the upstream end of the reservoir pool as a delta or fan shape. Because of the extremely large sediment load, aggradation in the reservoir head area would develop quickly. As the sediment wedge continues to grow it would impede bedload movement causing additional deposition upstream. The growing deposit would further attenuate sediment movement resulting in deposition both in the reservoir and in the upstream streambed. After this the stream would respond by developing a delta deposit through which the channel would again develop a braided pattern characteristic of high sediment loading.

Streamflows would continue to pass through the regulating outlets, with pools forming from larger storm events. Summer water levels would be low; water storage volumes of less than 1,000 acre-feet would not be uncommon. At times the pool would resemble a dry lake with a river flowing through it to the low level outlets, although a minimum pool would always be maintained to prevent trapped sediment from passing through the regulating outlets.

c. Suspended Particulate/Turbidity Determinations. Construction activities would contribute to the existing high suspended particulate and turbidity levels in the Toutle and Cowlitz Rivers. The relative increases caused by these activities would be inconsequential given the existing extremely-turbid and sediment-laden condition of these streams.

Once construction is completed, changes would occur in downstream erosion and sediment transport processes. Water passing through the reservoir will lose much of its sediment load, restoring its sediment suspension and transport potential. Therefore, although sediment from the debris flow in the North Fork Toutle River would be trapped and retained, the materials deposited downstream would undergo a period of renewed intense erosion. Overall, however, downstream sediment transport and deposition would be substantially reduced by the sediment retention structure.

d. Contaminant Determinations. Construction of the sediment retention structure and related features would not result in the introduction of contaminants into the North Fork Toutle River. Rock and earth fill materials would be obtained from sources near the construction site. Concrete used for construction would be placed in dry, and precautionary measures would be taken to prevent water used in preparing, curing, or cleanup of concrete from entering the waterway without prior treatment.

e. Aquatic Ecosystem and Organism Determinations. The aquatic ecosystem at the project site was destroyed by the mudflows of the May 18, 1980 eruption of Mount St. Helens. Natural recovery of the physical and biological system has already began, but the process of recovery is expected to be slow, requiring 75 to 100 years for re-establishment of pre-eruption conditions. The effects of the sediment retention structure on the aquatic ecosystem would be primarily in the alteration of these processes over the long-term recovery period.

The retention structure would block the migration of anadromous fish to the upper reaches of the North Fork Toutle River and its tributaries and eliminate these upstream areas from future fish production. Sediment trapped behind this structure would cover the existing streambed of the North Fork Toutle River and portions of tributary streams. During the period of active erosion of the debris avalanche and deposition of sediment behind the structure, conditions for re-establishment of aquatic habitat upstream of the retention structure would be poor.

Downstream of the structure, stabilization of the stream channel would occur more rapidly. Sediment transport, deposition, and turbidity would decline over the short term, improving conditions for the re-establishment of spawning and rearing habitat in downstream areas. Riparian vegetation along the lower river would reestablish at a more rapid rate.

Mitigation to reduce adverse effects to fisheries is being considered in coordination with Federal and State resource agencies. The recommendations of these agencies are contained in the U.S. Fish and Wildlife Coordination Act Report, which is included as exhibit 1 of the main report.

f. Proposed Disposal Site Determinations. The suspended particles caused by the proposed work would be widely dispersed by river currents and would not cause any significant adverse environmental effects.

The placement of the fill material would not violate Environmental Protection Agency or State water quality standards except possibly for a short duration during construction activities. Use of fill material would not introduce toxic substances into surrounding waters.

g. Determination of Cumulative Effects on the Aquatic Ecosystem. The recovery of the aquatic ecosystem would be affected by the proposed project to the extent described in paragraphs III.e. and III.h.

h. Determination of Secondary Effects on the Aquatic Ecosystem. Sediment retained behind the structure would permanently fill in the existing streambed and floodplain of the North Fork Toutle River. High turbidity levels and channel instability would continue for prolonged periods in the sediment impoundment area. Once maximum sediment retention is achieved, channel stability could occur across the plateau of impounded sediment.

Ponding of water would occur behind the retention structure. Streamflows would pass through the outlets, with pools forming from larger storm events. Water temperature increases in these pools would vary, depending on the retention time of the stored water. Significant heating is not expected to occur as long as the retention time is less than 30 days. Surface water released

after approximately 30 days would be expected to have increased 7° to 9°F above inflow temperatures. Once released, significant heat dissipation is expected because of turbulent conditions creating a good air/water interface during the daylight hours. Night air cooling would increase heat removed from the water. Most of the heat should dissipate during the first 24 hours following the release of the water.

Downstream of the structure, erosion of mudflow deposits would continue for two years and would decrease as channel stabilization and revegetation occurred. With the material from the debris avalanche retained in the upper Toutle valley, physical and biological recovery of the lower river would occur at a greatly increased rate compared to no action conditions.

IV. Findings of Compliance or Non-compliance with the Restrictions on Discharge

a. No significant adaptations of the guidelines were made relative to this evaluation.

b. Alternatives, including no action, have been considered and are addressed in the Environmental Impact Statement. Alternatives considered included: limited permanent evacuation, sediment stabilization basins, multiple retention structures with dredging, and multiple retention structures without dredging. The proposed action, a single retention structure at the Green River site, has been determined the most economical and environmentally acceptable alternative which would fully accomplish the objectives of the feasibility study.

c. The proposed action is in compliance with state water quality standards.

d. The proposed action would not violate the toxic effluent standards of Section 307 of the Clean Water Act.

e. Use of the sites would not harm any species or habitats designated as critical, endangered, or threatened under the Endangered Species Act of 1973.

f. The proposed action would not result in significant adverse effects on human health and welfare or recreational, esthetic, and economic values.

g. Appropriate steps to minimize potential adverse effects on the aquatic ecosystem would be specified in the construction contract.

With the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem, the proposed discharge is specified as complying with the requirements of Section 404(b) guidelines.

CHAPTER X - DISCUSSION, CONCLUSIONS, RECOMMENDATIONS

DISCUSSIONS

General

The problems resulting from the 1980 eruption of Mount St. Helens are unlike any others experienced in the United States. In the 4 years since the eruption, the Federal Government has expended in excess of $300 million to minimize damage and property losses from flooding and to maintain the navigation channel in the Columbia River. Coincidental with these activities, the Corps has devised a long-term strategy to alleviate the continued threats to people, property, and transportation presented by ever changing conditions. The impossibility of predicting accurately what natural phenomena may still occur at Mount St. Helens has complicated the response. Nonetheless, every reasonable effort has to be made to provide protection against such unknowns. Further, the amount and timing of sediment movement are critical factors in evaluating any long-term solution. Our current knowledge does not permit exact determinations concerning these items, necessitating the use of a range of assumptions in planning. Continued close cooperation among Federal, State, and local agencies, as well as continued careful professional monitoring of the erosion process will facilitate adjustments to any programmed solutions.

The long-range problems resulting from the Mount St. Helens eruption separate into two general categories: The first set of problems is associated with a debris dam blocking the outlet for Spirit Lake in the upper reaches of the Toutle River. If the debris dam were to give way, a disastrous flood would result in areas below. The second group of problems concerns the massive amount of sediment deposited in the Toutle River watershed. This sediment has not stabilized and continues to be transported downstream, creating flood threats by blocking the lower reaches of Toutle and Cowlitz Rivers. Continuing deposition of a portion of this sediment in the Columbia River also adds to the cost of maintaining the Columbia River navigation channel.

The issues associated with the debris dam blocking Spirit Lake have been resolved and construction of a tunnel to control water surface elevations in

Spirit Lake is underway. Details on Spirit Lake options and the recommended plan currently under construction are contained in the Decision Document, dated February 1984.

The long-term solution to the control of sediment is complex. The amount of sediment which must be provided for, the timing of any movement that will occur, provisions for nonhydrologic events (mudflows), and assurance that any strategy implemented will not worsen existing conditions all cause great uncertainty. This Feasibility Report presents the best estimate as to the amount and timing of sediment movement under normal hydrologic events. However, notwithstanding the accuracy of predicting sediment movements and other events, any program should provide flexibility to adjust to actual conditions. The most difficult sediment movement to predict and provide for is associated with the intensity of future precipitation and the characteristics of resultant runoff. This aspect of the problem is most critical in the early years, because over time stabilization will lessen average sediment delivery.

Excessive precipitation, with attendant flood runoff before stabilization takes place, causes movement of large amounts of material which must be controlled in order to avoid downstream flooding and navigational hazards. Fortunately, no catastrophic or unusual events have occurred. Temporary solutions, involving dredging reaches of the Toutle and Cowlitz rivers (emergency action and PL 98-63) and constructing temporary structures and small retention basins have prevented flooding and interference with navigation since the 1980 eruption. These temporary solutions, while providing protection on an interim basis, are expensive to maintain and do not provide the long-term security necessary to the 50,000 residents of the Longview, Kelso, and adjacent areas.

During the Comprehensive Plan studies (1982-83), a study team screened several measures that could provide long-term security to Cowlitz River communities. The two most feasible alternatives involved construction of either a large single retention structure (SRS) or smaller multiple retention structures (MRS) at sites on the main stem and North Fork Toutle rivers. Accordingly, analysis during preparation of this Feasibility Report concentrated on these two alternatives.

Specific Issues

As the feasibility study progressed, it became apparent that certain issues affecting the final recommendation had to be resolved. Those issues are presented and discussed below.

- o Risks, costs, and benefits associated with staged SRS for sediment movements less or greater than the projected estimate.

The study analyzed the sensivity of the preferred plan to sediment delivery uncertainties and staged construction. That analysis concluded that if the projected sediment delivery is one-half that estimated, continued dredging becomes the preferred plan, provided one assumes the risks associated with abnormal rainfall or a mudflow. Similarly, staged construction of the preferred plan is less costly if sediment delivered is one-half the estimated amount and a full-height structure is not required. Again, the inherent risks associated with other than the average annual delivery rates are ever present during the early years of project life. A thorough discussion of factors involved in staged construction and associated trade-offs is presented in chapter VI of the report.

- o Documentation of assumptions used to formulate the base condition against which alternatives were measured to arrive at the best solution to the sediment problem.

Levels of protection provided by interim dredging under PL 98-63 (60 years at Longview, 20 years at Kelso, 30 years at Lexington, and 10 years at Castle Rock, November-December 1983) were examined to determine if that effort is justified. The annual cost of maintaining existing sediment stabilization basins on the Toutle River and dredging in the Cowlitz River ($23.3 million), when compared to damages prevented ($127.5 million), resulted in average annual net benefit of $104.2 million and justifying that activity. Further, this measure is shown to satisfy short-term protection needs until a permanent program can be implemented. Columbia River navigation is also insured through these actions. Details on establishment and justification of the base condition are in chapters III and IV.

- o Types and dollar value of damages that may occur under the base condition for various storm events (1/10, 1/20, 1/50, and 1/100) at various points in time (1984, 1988, and 1994) for various sediment yields (1/2 E, E and 1-1/2 E).

Flood damages associated with the base condition are directly related to flood events of various frequencies. The base condition dredging primarily removes average annual sediment deposits. Depending upon its severity, a storm event occurring at some point in time would cause damage uncontrolled by base condition dredging. As an example, had a once in 10-year frequency storm event occurred in November 1983 (established baseline condition), total damages, primarily in unleveed areas, would have amounted to $4,121,000. Damages would increase if a greater than 1-in-10-year event had occurred, with a 100-year event exceeding safe levee heights at all locations and producing estimated flood damages of $177 million. These damages would be similar in out years (1988, 1994) regardless of the rate of average annual sediment delivery. Complete descriptions of damages and a discussion of storm events are contained in Chapters III and IV.

- o Types and dollar value of residual damages from storm events of various frequencies (1/10, 1/20, 1/50, and 1/100) for 1984, 1988, and 1994 for various sediment delivery rates (1/2 E, E, 1-1/2 E) if emergency floodfight activities are implemented and temporary levees are maintained.

Although dredging activities to maintain the base conditions prevent an estimated $127 million in damages, some losses which could be prevented by other than dredging activities will still occur. The analysis examined reduction of damages through emergency floodfight activities.

Emergency floodfight activities would focus on evacuation of residents. The nature of storm events is such that insufficient mobilization time exists from the moment a flood event is anticipated and it actually occurs. Also, access to levees is severely restricted due to nearby dwellings and extensive urban development in areas adjacent to the permanent structures. Floodfighting activities would cost an estimated $26 million and would not reduce property damages significantly. The cost of evacuation is a preliminary number,

based on inhouse evaluation, and has not been coordinated yet with local emergency operation officials. Reduction of damages due to maintenance of the temporary structures is insignificant and would have no impact on enhancing the base condition. The foregoing is true for all storm events at any point in time, regardless of the rate of average annual sediment delivery. Details of the analysis are contained in chapter III of the feasibility report.

- o Comparative analysis of costs, risks and benefits associated with one-time construction of an SRS or staged SRS and dredging will be kept current.

Because of uncertainties with sediment delivery rates, a sediment monitoring program has been in operation since the 1980 eruption. As more data is gained from that program, better and more accurate sediment projections will evolve. During continued planning and engineering studies, that data will be used in final preparation of design documents to insure flexibility to meet changing needs.

Once the study determined the best projected sediment delivery rates, application of standard planning and project formulation procedures showed an SRS at Green River site on Toutle River as the most feasible solution. A 177-foot-high structure at that location, coupled with downstream actions (dredging), achieved the greatest net benefit when compared to the base condition and was selected as the NED plan. A sensitivity analysis of the NED plan reaffirmed its capability to accommodate the expected sediment delivery rate (299 mcy) under average conditions for the 50-year project life. Further analysis indicated the NED plan also provided sufficient storage to accommodate both the 100-year storm event (14 mcy sediment load) and a design mudflow (75 mcy) during the early years of the project, when such storage capacity is most critical. Beyond the initial critical years, sediment delivery begins to diminish and storage for abnormal events is less a factor. Accordingly, the NED plan is the preferred plan. Details on the NED plan are contained in chapter V of the Feasibility Report.

- o Resolution of the need for relocation of State Highway 504

A major portion of the original right-of-way of State Highway 504 lies within the proposed project area. It provided the general public access to the Spirit Lake recreational areas, as well as serving the needs of private and state agencies in the general area. The mudflow at the time of the original eruption of Mount St. Helens destroyed the old highway in the general area of the proposed project. This highway was partially reestablished on a temporary basis as shown on plate 22, appendix D.

The State will determine if reestablishment of State Highway 504 is necessary to serve the public's interest and to promote continued regional economic growth. The initial corridor alinement goes through the Green River site up to Coldwater Lake. This alinement utilizes a portion of the existing temporary route of State Highway 504 in this area. The alinement was developed based on the economic costs of rights-of-way, construction, and continued maintenance. Funds for the route, if approved, would be available to the State from emergency monies provided by the Federal Highway Administration. Funds are currently available and reserved for the State of Washington for this specific replacement. The State has started planning efforts and could finalize the construction plans for the realinement of State Highway 504 upon establishment of the public need.

A portion of the highway realinement falls within the proposed project boundary and will be affected by the construction of the Green River structure and its subsequent debris retention area. Studies indicate that the next most economically feasible alternate route which bypasses the project area would increase the cost of highway replacement by an estimated $4,300,000. This increased dollar amount is not available to the State under the existing Federal Highway Administration funds of $18 million.

Should the State of Washington establish a continued public need for State Highway 504, the additional costs associated with the proposed relocation would be considered an appropriate project feature cost and would require approval and authorization.

CONCLUSIONS

1. The potential for flooding in communities along the Cowlitz River, damage to the transportation corridor, and impacts to navigation on the Columbia River require implementation of permanent measures to manage the risk created by the movement of sediment.

2. Based on the analysis performed during this study, a plan consisting of a single retention structure at Green River and supplemental downstream actions best meet the objective of developing a long-term plan to deal with flood and navigation problems resulting from the Mount St. Helens eruption. This plan also achieves the highest economic efficiency consistent with preservation of life and property and most effectively deals with variations in quantities of sediment delivery.

3. What we now know about the sediment budget, as presented in this report, shows a need for immediate action. Any delay in the construction of a permanent solution only increases the flood risk in Cowlitz County and commits the Federal Government to potentially greater expenditures.

4. Coordination with nationwide experts in the field of sedimentation indicates that reported sediment predictions reflect the experience of the last four years. Because of the uncertainties associated with volcanic and hydrologic events, we will continue to learn more about sediment deposition over time and the associated risks.

5. The Congress has established a Federal role in flood damage reduction. However, the flood problems stemming from the after-effects of the Mount St. Helens eruption created a unique situation. As a result, past Federal emergency efforts and the Presidential commitment to respond to any future life or property threatening emergency lay the foundation for a Federal role in the Cowlitz and Toutle rivers. The Federal responsibility in navigation is based on the existing authorized navigation project for the Columbia River.

6. A single retention structure at the Green River site has less impact on fisheries when compared with other alternatives. However, it will impede fish passage into the upper Toutle above the structure. Initial design and construction considers facilities for fish passage using trap and hauling methods. All costs associated with the construction of the fish passage facilities should be a Federal responsibility. No other mitigation is found to be justified.

7. Requirements for annual sediment removal by downstream dredging should be analyzed each year, through the plan's sediment monitoring program.

8. During the next several years no matter which alternative is selected for expedited implementation as a permanent solution, dredging will continue and additional insight will be obtained about the rate, and likely future magnitude of sediment deposition. Therefore, the comparative analysis of risks, benefits and costs, and design, at an equal level of detail, of one-time construction of an SRS, staged SRS, and dredging will be kept current during the continued planning and engineering phase and will respond to new information. Adjustments to the preferred alternative will be made as may be indicated by current data and another solution may be selected if there are compelling and convincing reasons for so doing.

9. No provisions should be made that preclude raising a completed structure above the preferred height if future conditions warrant.

10. This Federal project should be exempt from the imposition of all Washington State and local sales, use, and associated excise taxes (Title 82 of the Revised Code of Washington) on the value of the services and materials provided under Federal contracts and subcontracts.

The recent decision of the United States Supreme Court in Washington v. United States, 103 S. Ct. 1344 (29 March 1983), held that the State may impose such taxes on Federal contractors unless the Congress specifically exempts contracts arising under a particular Federal program. Such an exemption should be provided by Congress in this instance. In any event there should be assurance that the limited monies allocated for the authorized program are actually spent only to provide for the specific benefits identified in this report.

RECOMMENDATIONS

After careful consideration of the environmental, social, and economic impacts of alternatives for controlling sediment deposition in the Toutle, Cowlitz, and Columbia Rivers, I recommend that the Secretary of the Army, acting through the Chief of Engineers, be authorized to construct as a Federal project for flood damage and navigation maintenance reduction, a single retention structure and associated downstream actions. The single retention structure which is described as the preferred plan, would include such modification as the Chief of Engineers deems advisable, such as provisions to raise the structures should future conditions warrant.

The first cost of the preferred plan to the United States is presently estimated at $197,200,000; average annual opertion, maintenance, and sediment monitoring costs to the United States are estimated at $925,000. Costs for maintaining the congressionally authorized 40-foot Columbia River navigation channel are excluded from costs of the preferred plan as they are regularly provided through the Corps of Engineers annual operations and maintenance budget.

Through continuous monitoring, additional information will be obtained about the rate and future magnitude of sediment deposition. If up-to-date analysis of sediment deposition and of benefits and costs of alternatives provides compelling and convincing reasons, selection of another alternative (such as a staged retention structure or dredging) may be warranted. Accordingly, concurrent analysis and design of a single retention structure, staged single retention structure, and dredging alternatives will continue. The authorization should contain sufficient flexibility to move to one of these alternatives if conditions warrant.

Authorization and subsequent implementation of a Federal project for flood damage and navigation maintenance reduction is subject to the provision that non-Federal interests shall agree to comply with the following:

a. Be responsible for conveying to the United States, prior to the time needed and without cost, all lands, easements, and rights-of-way for the single or staged retention structure and be responsible for providing without cost to the United States all lands, easements, and rights-of-way required for dredging and downstream actions, including borrow areas and dredged material disposal areas for excavated material including necessary retaining works, as determined necessary by the Chief of Engineers, for project construction and subsequent maintenance; and accomplish without cost to the United States all alterations and relocations of buildings, roads, bridges, and other structures or utilities made necessary by implementation of the project;

b. If any of the above requirements cannot be provided in a timely manner, provide a cash contribution to the United States, prior to the time needed in an amount which the Chief of Engineers determines to be necessary to allow acquisition of needed property by the United States. A final contribution adjustment to be made after actual costs are determined;

c. Operate and maintain any federally undertaken mitigation project which is determined to be justified, such as the operation and maintenance of fisheries facilities for a single retention structure;

d. Maintain all dredged material disposal sites.

In addition, I recommend that project authorization exempt the Federal Government and its contractors from the imposition of the Washington State Sales and Use Tax (Chapters 82.04, 82.08, 82.12, and 82.14 of the Revised Code of Washington), on the value of the services and materials provided under Federal contracts.

The recommendations do not reflect program and budgeting priorities inherent in the formulation of a National Civil Works construction program, nor the perspective of higher levels within the Executive Branch.

Consequently, the recommendations may be modified before they are transmitted to the Congress for authorization and/or implementation of funding.

R.L. Friedenwald
Colonel, Corps of Engineers
District Engineer

NPDPL-PF (Dec 84) 1st End
SUBJECT: Mount St. Helens, Washington
Feasibility Report & Environmental Impact Statement

DA, North Pacific Division, Corps of Engineers
P. O. Box 2870, Portland, OR 97208-2870 18 December 1984

TO: Chief of Engineers

I concur in the conclusions and recommendations of the District Commander.

George R. Robertson
GEORGE R. ROBERTSON
Brigadier General, USA
Commanding

EXHIBIT 1

FISH AND WILDLIFE COORDINATION

EXHIBIT 1

FISH AND WILDLIFE COORDINATION

This exhibit contains the U.S Fish and Wildlife Service Coordination Act Report (CAR), Corps point-by-point response to the CAR recommendations, and a biological assessment as required under Section 7(c) of the Endangered Species Act.

The following general approach was used regarding the recommendations of USFWS. We propose to provide fish passage facilities as part of the Single Retention Structure. Justification for such facilities can be provided and such facilities must be made an integral part of any single retention structure design; please refer to Appendix E regarding justification of these facilities. We propose to recommend that the operation of the fish passage facilities be provided by the State of Washington. We do not propose to acquire any lands or easements for specific fish and wildlife mitigation purposes. However, we do propose to manage lands acquired for the reservoir to provide wildlife habitat primarily by protecting and preserving wildlife habitat of these lands and to provide some limited revegetation.

RESPONSE TO COORDINATION ACT REPORT RECOMMENDATIONS

Presented in this section are the Corps of Engineers responses to the U.S. Fish and Wildlife Service recommendations contained in their final Coordination Act Report for the feasibility study addressing proposed sediment control actions for the Toutle, Cowlitz, and Columbia River Systems. We have carefully reviewed this report and their recommendations and have the following general and point-by-point responses to those recommendations.

GENERAL RESPONSE

Overall, the report does a commendable job in addressing a very complex and confusing issue - the rapidly changing fish and wildlife habitat of the project area coupled with the system-wide affects associated with the sediment reduction project being evaluated. However, the report fails to clearly identify and separate the effects on fish and wildlife caused by the eruption and those relating to the sediment control project being proposed. The chronology of fish and wildlife habitat recovery that is used for the with and without project condition greatly effects the manner and results of fish and wildlife impacts that may be anticipated. While many uncertainties do exist regarding the physical recovery of the project area, the estimate that we must base our review upon are the recovery projections presented within the feasibility study. In addition, the numerous economic values shown in your report to justify your mitigation recommendations do not fully comply with procedures delineated in Principles and Guidelines for Water and Related Land Resources Implementation. Our point-by-point responses follow.

SPECIFIC COMMENTS

General recommendations of U.S. Fish and Wildlife Service

Recommendation 1. If a SRS is considered necessary, then the Green River site be given preference for construction of a dam. The LT-3 and Kid Valley sites should be rejected because dams at these sites would produce unacceptable losses of fish and wildlife resources and habitat.

Response 1. We agree that the Green River site is preferrable to the LT-3 and Kid Valley site for fish and wildlife and also for engineering reasons. A single retention structure at the Green River site is the preferred plan in the feasibility report.

Recommendation 2. Fish and wildlife be made an authorized purpose of the project to ensure that action is taken to plan and implement appropriate mitigation measures.

Response 2. The primary objective of the feasibility study is to address the sedimentation problem and concomitant flood and navigation threat. We consequently do not believe including fish and wildlife as a project purpose is appropriate. However, in the recommendations presented in the feasibility report, we have included all mitigative measures for potential authorization by Congress that we believe are reasonable and appropriate.

Recommendations 3. In keeping with the requirements of the Fish and Wildlife Coordination Act, all capital and operation and maintenance costs for fish and wildlife mitigaton be treated as an "integral part of the cost of the project."

Response 3. All reasonable and necessary mitigation costs have been included in the feasibility report, including the institutional arrangements proposed for capitol costs and operation and maintenance.

Recommendation 4. All lands, water, and interests therein to achieve mitigation goals be acquired by the federal construction agency as stipulated in Section 3(c) of the Fish and Wildlife Coordination Act.

Response 4. To the extent authorized by Congress, we will carry out all fish and wildlife mitigation requirements for this project. Our findings and recommendations regarding the part of project costs, including mitigation costs, that should be borne by non-Federal interests are shown in the feasibility report in the section pertaining to cost sharing.

Recommendation 5. Necessary fish and wildlife studies and associated funding be included in any future authorization for the preferred alternative.

Response 5. Included in the recommendations for potential authorization are provisions for reasonable and necessary fish and wildlife studies.

Recommendation 6. The Corps of Engineers provide funds to fish and wildlife agencies to monitor construction impacts and the effectiveness and adequacy of mitigation programs for fish and wildlife. Approximate costs for a 25-year study which includes 5 years of continuous monitoring with periodic monitoring at 5-year intervals for 20 years thereafter amount to $840,000. A monitoring program for fish and wildlife should include studies of the following topics.

a. Water quality

b. Streamflow

c. Fish population recovery as affected by the project

d. Aquatic food chain recovery as affected by the project

e. Stream habitat recovery upstream and downstream of the project

f. Rearing pond site evaluations

g. Fish passage success

h. Wildlife studies should include monitoring of wildlife responses to project features within the study area.

Fish and Wildlife monitoring would be done concurrently and in cooperation with the Corps' 25-year project monitoring efforts.

Response 6. We believe that the evaluations and studies you have recommended are too general and all-encompassing. Many of the studies you have recommended are not directly related to this project, but rather are studies

that are more oriented toward determining impacts of the eruption and the recovery of fish and wildlife from that devastation. While we believe that certain studies relating to water quality, streamflow, and success of fish passage measures are warranted, we believe that the other studies you have recommended should more appropriately be a responsibility of the local fish and wildlife agencies as part of their normal monitoring process. We will coordinate with you the extent of studies and appropriate agency to provide those investigations relating to water quality, streamflow, and the success of fish passage facilities.

Recommendation 7. The Corps of Engineers modify mitigation measures if results of monitoring studies find such changes to be warranted.

Response 7. The primary mitigation proposed as part of the feasibility report is the construction of fish bypass facilities as part of the single retention structure. If it is determined that these facilities are inadequate, studies would be initiated to develop and, if justified, to construct new improved fish passage facilities or other mitigative measures.

Recommendation 8. Construction and non-emergency dredging activities be scheduled to protect fish and wildlife (i.e., inwater work periods, etc.). Construction techniques to protect fish and wildlife as specified by federal and state resource agencies should be incorporated in construction contracts. Contract inspection efforts should include participation by fish and wildlife biologists. This is estimated to cost $80,000 annually over the 2-year construction period. This amount is included in the monitoring program cost detailed in Recommendation 4.

Response 8. We will continue to coordinate all inwater work activities with your agency and other resource agencies in the future. To the extent reasonable and practicable, we will schedule all our activities to minimize impacts to fish and wildlife. We also plan on establishing an environmental task force to provide recommendations on minimizing adverse impacts to fish and wildlife resources during the construction period; funds appropriate to this level of involvement will be transferred to your agency.

Recommendation 9, 10, 11, 12. Existing habitats of high value to wildlife not be used as disposal sites for dredge spoils.

Areas of lower value to wildlife such as diked pasture and/or old dredge spoil disposal sites be used for dredge spoil disposal.

Herbaceous and woody vegetation be established on dredge spoil areas immediately after spoil is deposited.

Wetland creation in dredge spoil areas be investigated and implemented where feasible.

Response 9, 10, 11, 12. We will continue to coordinate all dredged material disposal with your agency and other resource agencies. We will continue to utilize disposal sites of lesser fish and wildlife value when these sites are available. As you should be fully aware, however, the magnitude and quantity of sediment that must be managed as part of this project may not allow us to limit disposal to only sites of low wildlife value. Disposal sites that have been and will be used are provided by local sponsors. The sites that have been used are seeded with herbaceous vegetation after dredged material has been deposited as part of the disposal contract. Since the Corps of Engineers does not manage these local sponsor provided disposal sites, it is not possible to comply with some of the items you have recommended. The eventual use of the disposal site would be dependent upon the land owner. However, since the State of Washington provided many of the larger disposal sites, it may be possible that many of the disposal sites could be managed for fish and wildlife enhancement. We recommend that you contact the State of Washington and provide them with your recommendations for disposal site management.

Recommendation 13. Loss of important fish and wildlife habitat due to project impacts be mitigated by development and/or improvement of other areas.

Response 13. As discussed in response to your previous recommendations, disposal sites, including the Green River Sediment Retention Structure area, may be provided by local sponsors. If any justified mitigation for the use of these sites is warranted, we believe that this should be coordinated with

these local sponsors. We do not propose, as part of our recommended plan, any land acquisition beyond that directly necessary to meet direct project needs.

Recommendation 14. The property behind the Green River structure be managed for fish and wildlife and recreational uses thereof.

Response 14. We believe that this is a reasonable use for the area behind the SRS. We will discuss this recommendation with the local sponsor who, as proposed in the cost-sharing proposal, would purchase this property.

SPECIFIC RECOMMENDATIONS

Toutle River

Recommendation 1. Successful passage be provided for anadromous fish at all barriers erected to trap sediments. Passage would be required for downstream migrating juvenile salmonids and adult fish moving upstream. Planning for and final design of such mitigation facilities must be approved by the resource agencies prior to construction of any sediment retaining structure. A trap and haul facility for adults would cost an estimated $1,000,000 in addition to annual operation and maintenance costs of $100,000. Downstream passage costs are not available.

Response 1. We propose to provide fish passage as part of the construction of the SRS. We will coordinate the planning of these facilities with the appropriate resource agencies.

Recommendation 2. When feasible, a single defined stream channel be maintained in summer through impounded sediments to improve adult and juvenile fish passage.

Response 2. We will investigate the feasibility of this recommendation.

Recommendation 3. A stream channel designed to permit fish passage and prevent stranding of adult and juvenile salmonids be maintained through all work areas (including the LT-1 and LT-3 dredging sites).

Response 3. As in prior construction contracts for operation of the sediment retention structures, we will specify that a stream channel be maintained through these work areas to permit fish passage and to prevent stranding of adult and juvenile salmonids.

Recommendation 4. Rearing ponds be constructed to mitigate losses of Alder Creek and Deer Springs fish facilities inundated by sediment.

Response 4. If these facilities are inundated by sediment as a result of construction of the SRS, they would be replaced consistent with all other project related relocations.

Recommendation 5. Riparian and instream habitat be improved at project cost at sites downstream of the Green River Dam to mitigate for project-related losses of instream and riparian habitat. Possible sites for riparian plantings include Disappointment, Trouble, Goat, and Dollar Creeks at a cost of about $82,000. These restoration measures should be implemented concurrently with the 2-year dam construction period. Suitable instream habitat improvement sites include, but are not limited to, the mainstem Green and South Fork Toutle Rivers, Devils and Thirteen Creeks, and at an unnamed South Fork tributary (Section Lines 22 and 23, T9N, R2E). Costs for the mainstem work would range from $60,000 to $212,000 and for the passage improvements about $100,000. The final selection of suitable mitigation measures and sites should be accomplished through a coordinated planning effort involving the Corps, affected landowners, public land management agencies, and fish and wildlife agencies.

Response 5. Some of the actions recommended appear to have merit from a fish and wildlife perspective and also in providing some additional sediment control benefits. Since incremental justification for these actions have yet to be determined, we propose to investigate these recommendations in greater detail in the Continued Planning and Engineering Stage to determine benefits, costs, and institutional arrangements for potential implementation. Since the Department of Interior has existing authorities to provide passage at obstructions to anadromous fish migration, we recommend that the passage improvements you have delineated be provided by your agency.

Recommendation 6. Wildlife habitat within the sediment storage area upstream of the SRS be maintained as long as possible. Lands outside the sediment inundation zone, but within Corps ownership, should also be maintained for wildlife. Timber harvest should cease on this land to minimize the impact of wildlife lost gradually over the 50-year project life.

Response 6. This is a very reasonable recommendation for minimizing loss of wildlife habitat. However, before we can reply to this recommendation, we will have to analyze the impact of additional debris to the structure and the spillway. We will advise you of our findings. One point of clarification, however, these lands may not be owned by the Corps but by the local sponsor.

Recommendation 7. The LT-1 and LT-3 disposal sites be finished in irregular contours, seeded, planted to woody vegetation, and fertilized to aid in erosion control and development of wildlife habitat. Costs associated with vegetative plantings are about $98,300.

Response 7. The dredged material disposal sites that you have referenced are owned by local sponsors. If agreed to by these sponsors, we will finish these sites in irregular contours. We propose to seed and fertilize these sites at the conclusion of disposal activities. The planting of woody vegetation would be a responsibility of the land owner. For the LT-1 site, the landowners are the State of Washington and Cowlitz County. We propose that our respective agencies meet with these landowners.

Recommendation 8. Periodic seeding and fertilization of the sediment inundation area with Dutch white clover, orchard grass, and red clover mix continue throughout the life of the project.

Response 8. The area at the edge of the pool is a very volitile reach, where inundation could occur at any time. Consequently, we do not believe that spending funds to provide very temporary wildlife habitat in this area is justifiable. Once the sedimentation and infilling of the reservoir subsides, then, it is reasonable for someone to provide the seeding you recommend.

Recommendation 9. Elk forage such as ninebark, huckleberry, salal, and Oregon

grape be planted on Corps lands outside the sediment inundation zone to replace forage lost to sediment coverage.

Response 9. These lands, as proposed in the cost-sharing proposal, may be owned by local sponsors. We will discuss this recommendation with the sponsor to develop the institutional arrangements for providing needed wildlife habitat.

Recommendation 10. Existing herbaceous vegetation be maintained at the base of the debris avalanche. Any part of the seeded debris avalanche which is under Corps ownership should be maintained to benefit deer and elk.

Response 10. See response #9.

Recommendation 11. Temporary protection of existing riparian vegetation along the Green River, North Fork Toutle River, and upper Hoffstadt Creek drainages be established to offset wildlife habitat losses within the sediment inundation zone. The major action needed would be cessation of timber harvest in the riparian zone. This protection would begin at the time of project construction and would be dropped as mitigation is implemented. Specific actions should be developed through a cooperative planning effort involving the affected landowners and fish and wildlife agencies.

Response 11. Initiating the specific forest practices you have proposed is a State responsibility. The State of Washington currently has a Forest Practices Act.

COWLITZ RIVER

Recommendations 1 and 2. Disposal areas be finished in irregular contours to increase habitat diversity.

Eroding streambanks and dredge spoil disposal areas be fertilized and revegetated immediately with herbaceous and woody plants.

Responses 1 and 2. Please refer to Toutle River response #7.

Recommendation 3. Public access be provided to State owned or managed disposal areas.

Response 3. Public access to State owned area is a responsibility of the State.

COLUMBIA RIVER

Recommendation 1. As much bedload material as possible be kept out of the Columbia River System, and especially the estuary by:

a. Operation of the Cowlitz River Sump;

b. Establishment of sumps in the Columbia where there are adequate upland disposal sites.

Response 1. We concur with your recommendation.

Recommendation 2. In-water disposal sites for dredge spoils be located where material would not be deposited in shallow water areas or entrances to sloughs and backwaters.

Response 2. To the extent practicable, we will comply with this request.

Recommendation 3. Dredged materials be disposed of in the following sites in order of priority; 3, 1, 5, 11, 10, 3, 18, 15, 9, and 13 (Figures 16 and 17).

Response 3. To the extent practicable, these sites will be given priority for dredged material disposal.

Recommendation 4. Mitigation for habitat values lost be required before use of sites 2, 9, 13, 15, 18, 19, 23, and 24. Assuming that some of these sites are used for dredge spoil disposal, the estimated mitigation cost for this measure would range from $250,000 to $1.5 million.

Response 4. While Columbia River dredging is discussed in the feasibility report to provide a comprehensive evaluation of impacts, no specific

authorization or funding is requested for actions necessary to maintain this navigable waterway. Authority is already provided under P.L. 87-874 for actions pertaining to federal maintenance of the Columbia River navigation channel. As part of this authorization, local sponsors are to provide the lands necessary for dredged material disposal. We are willing to discuss the use of these local sponsor provided disposal lands under the coordination procedures established for this maintenance dredging. Construction of the SRS, as proposed, would substantially reduce the Columbia River dredging requirement.

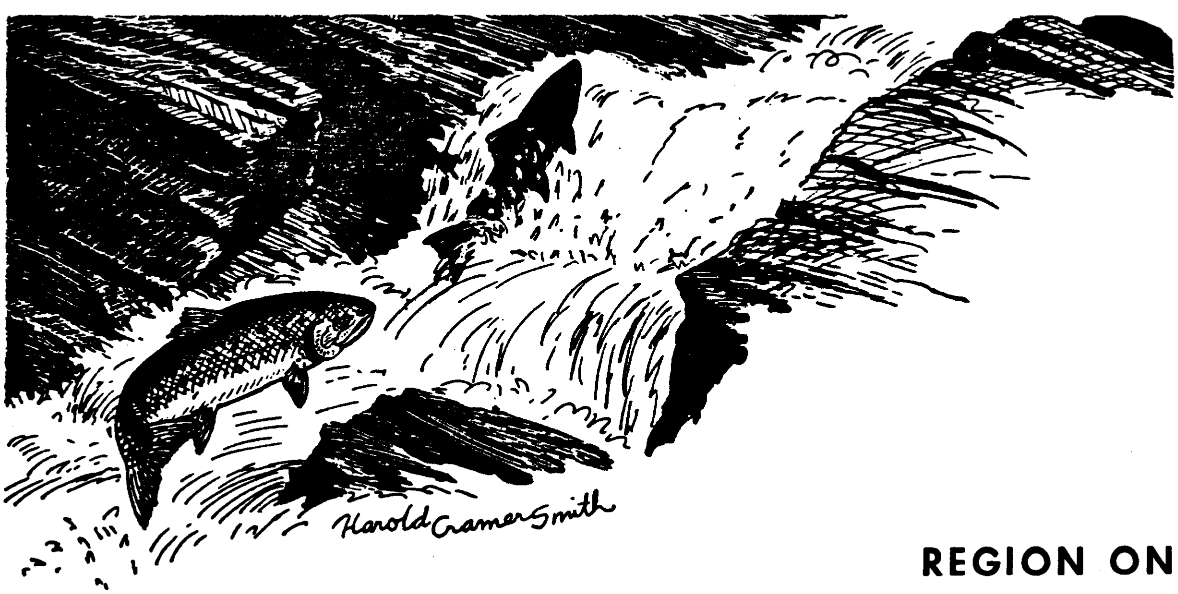
Recommendation 5. A plan be developed under the authority of the Fish and Wildlife Coordination Act which identifies specific actions needed to mitigate for impacts of dredging and dredged material disposal. This plan should be guided by a task group of interested agencies, and should be developed to address both short- and long-term dredging needs and concerns. The plan would cost an estimated $50,000 and should be developed concurrently with detailed planning for project facilities (approximately 12 months). As the construction agency, the Corps would be responsible for implementation of mitigation measures identified through this planning process. These measures should be implemented concurrently with project dredging activities.

Response 5. We are willing to participate in discussions relating to Columbia River navigation channel maintenance within the coordination mechanism developed for these activities.

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

THE IMPACTS ON FISH AND WILDLIFE OF PROPOSED SEDIMENT CONTROL ACTIONS FOR THE TOUTLE, COWLITZ, AND COLUMBIA RIVER SYSTEMS



REGION ONE

DECEMBER 1984

FISH AND WILDLIFE COORDINATION ACT REPORT

THE IMPACTS ON FISH AND WILDLIFE OF PROPOSED ACTIONS FOR CONTROLLING FLOODING AND NAVIGATION PROBLEMS CAUSED BY THE ERUPTION OF MOUNT ST. HELENS

by

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December 1984

Prepared for the Portland District
U. S. Army Corps of Engineers
by the
Portland and Olympia Ecological Services Field Offices
U. S. Fish and Wildlife Service

PREFACE

This is the Fish and Wildlife Service's detailed report on the Corps of Engineers' Mount St. Helens, Washington Feasibility Study.

Our analysis of project impacts on fish and wildlife is based on: 1) project information and engineering data received prior to November 30, 1984; 2) an appraisal of existing and projected resources; and 3) a project life of 50 years. Previous reports submitted on this project are planning aid letters in March and April 1983 and May 1984, and a reconnaissance report of September 1983.

This report does not constitute the review comments of the Department of the Interior on the draft environmental impact statement as required under provisions of the National Environmental Policy Act (Public Law 91-190). It should also be noted that the proposed project may be subject to permits over which the Fish and Wildlife Service has review responsibilities. Accordingly, our comments do not preclude an additional and separate evaluation by the Service, pursuant to the Fish and Wildlife Coordination Act (16 U.S.C. 661, et seq.), if eventual project development requires a permit from the Corps of Engineers, U.S. Army (Section 10 of the River and Harbor Act of 1899). All such permits are subject to separate review by the Service under existing statutes, executive order, memorandum of agreement, and other authorities. In review of permit applications, the Fish and Wildlife Service may concur, with or without stipulations, or object to the proposed work, depending on specific construction practices which may impact fish and wildlife resources.

The recreational and commercial values assigned to salmon and steelhead are derived from the following report, "Net Economic Values for Salmon and Steelhead from the Columbia River System" developed for the National Marine Fisheries Service by Meyer-Zangri Associates, Inc. All values derived from this report reflect 1980 dollars and no attempt has been made to incorporate inflationary updates. Values for searun cutthroat, resident trout, and wildlife were derived from data provided by the Washington Department of Game.

The U. S. Fish and Wildlife Service mitigation policy (Federal Register, 1981) was used in preparing this report. This policy assures consistent and effective recommendations for project mitigation and outlines various methods for achieving such mitigation. The policy covers impacts to fish and wildlife populations, their habitat, and the human uses thereof.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
LLOYD 500 BUILDING, SUITE 1692
500 N.E. MULTNOMAH STREET
PORTLAND, OREGON 97232

December 13, 1984

Colonel Robert L. Friedenwald, District Engineer
Portland District, Corps of Engineers
P. O. Box 2946
Portland, Oregon 97208

Dear Colonel Friedenwald:

This expresses the Fish and Wildlife Service's position on the effects of a proposed project to control sedimentation and flooding in the Toutle, Cowlitz, and Columbia Rivers. The proposed work would be implemented because of existing and potential problems associated with the 1980 eruption of Mount St. Helens. This statement and the attached detailed report constitute our Fish and Wildlife Coordination Act Report in accordance with Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and is consistent with the intent of the National Environmental Policy Act. Our report is intended for inclusion in your Feasibility Report which was authorized by recommendation of the Assistant Secretary of the Army. This recommendation was contained in a Corps of Engineers (Corps) report to the President on a comprehensive plan for responding to the long-term threat created by the 1980 eruption of Mount St. Helens.

This report has been coordinated with and has the concurrence of the Washington Departments of Fisheries and Game and Oregon Department of Fish and Wildlife as indicated in their attached letters of December 3, December 4, and November 30, 1984, respectively. It was also developed in cooperation with the National Marine Fisheries Service.

Project features being evaluated include three Single Retention Structure (SRS) alternatives on the North Fork Toutle River. The SRS concept consists of construction of a dam to create a slack-water pool in which a major portion of water-borne sediments would settle or drop out. This would prevent large quantities of materials from entering the lower Cowlitz and Columbia Rivers, minimizing future dredging

requirements and the problems associated therewith. A total of 14 different spillway height and outlet structure combinations are included in the SRS analysis.

The Supplemental Appropriations Act of 1983 (PL 98-63) authorized the Corps to implement and maintain flood control measures to assure 100-year flood protection for developed areas on the Cowlitz and Toutle Rivers and to reduce sediment flow into the Columbia River. Under PL 98-63, the levees along the Cowlitz have been raised and dredging has occurred on the Cowlitz between RM 13.5 and 20 and at the sediment stabilization basin, LT-1, on the Toutle River. These actions are considered the base condition for the proposed project.

Sumps dredged near the mouth of the Cowlitz River are also included in the proposed project. Materials settling in the sumps would be removed and placed in water and on wetland and upland sites.

The Service's analysis indicates that project construction and operation could cause serious impacts on fish and wildlife resources. Large runs of anadromous fish could be blocked from spawning areas, valuable fish and wildlife habitat could be permanently lost in the SRS pool(s), and wildlife habitat could be covered with material dredged from channels and sumps. The no action alternative could also cause serious impacts to fish and wildlife as large quantities of Mount St. Helens materials would settle in the Cowlitz and Columbia Rivers (including the Columbia River Estuary). These materials would smother inwater habitats and require extensive maintenance dredging which would in turn cause loss of wildlife habitat at disposal sites. A given assumption for all project analyses is that maintenance dredging would continue on the Columbia River to maintain the 40-foot navigation channel.

The basic premise behind the Service's analysis of impacts is that the rapid, natural recovery of important fish and wildlife habitats that has been observed since the blast, would continue in the future without a project. It is assumed that eventually the area would return to its preblast conditions for fish and wildlife resources. These resources were of significant value to the local area, both socially and economically, and are assumed to be so in the future. Thus, while project features might be built or operated in areas where the habitats are presently degraded, to the extent they would prevent the natural and otherwise uninterrupted recovery of the area, they would have potential impacts to fish and wildlife resources.

Previous drafts of this report contained recommendations which, because of the number of potential alternatives and the lack of specific project information, were necessarily general. Those recommendations represented a full range of potential mitigation actions for all of the alternatives. However, with selection of a preferred plan at the Green River site, fewer and less extensive mitigation actions would be required. While all the alternatives are still discussed within the report, the recommendations have been developed specifically to mitigate for losses associated with the selected plan and its specific impacts.

With input from other federal and state resource agencies, the Service has developed the following recommendations to mitigate for project impacts to fish and wildlife resources. It should be noted that the recommended actions address project impacts only. They are not designed to mitigate for impacts of the eruption of Mount St. Helens. It should also be noted that the recommended actions are designed to be accomplished concurrently with detailed planning and construction of project features. Ultimately, their purpose is to assist in developing an environmentally sound project compatible with applicable environmental policies and legislation, without delaying necessary efforts to solve flooding and sedimentation problems associated with the eruption of Mount St. Helens.

RECOMMENDATIONS

It is recommended that:

1. If a SRS is considered necessary, then the Green River site be given preference for construction of a dam. The LT-3 and Kid Valley sites should be rejected because dams at these sites would produce unacceptable losses of fish and wildlife resources and habitat.

2. Fish and wildlife be made an authorized purpose of the project to ensure that action is taken to plan and implement appropriate mitigation measures.

3. In keeping with the requirements of the Fish and Wildlife Coordination Act, all capital and operation and maintenance costs for fish and wildlife mitigation be treated as an "integral part of the cost of the project."

4. All lands, water, and interests therein to achieve mitigation goals be acquired by the federal construction agency as stipulated in Section 3(c) of the Fish and Wildlife Coordination Act.

5. Necessary fish and wildlife studies and associated funding be included in any future authorization for the preferred alternative.

6. The Corps of Engineers provide funds to fish and wildlife agencies to monitor construction impacts and the effectiveness and adequacy of mitigation programs for fish and wildlife. Approximate costs for a 25-year study which includes 5 years of continuous monitoring with periodic monitoring at 5-year intervals for 20 years thereafter amount to $840,000. A monitoring program for fish and wildlife should include studies of the following topics.

   a. Water quality

   b. Streamflow

   c. Fish population recovery as affected by the project

   d. Aquatic food chain recovery as affected by the project

   e. Stream habitat recovery upstream and downstream of the project

   f. Rearing pond site evaluations

   g. Fish passage success

   h. Wildlife studies should include monitoring of wildlife responses to project features within the study area.

   Fish and Wildlife monitoring would be done concurrently and in cooperation with the Corps' 25-year project monitoring efforts.

7. The Corps of Engineers modify mitigation measures if results of monitoring studies find such changes to be warranted.

8. Construction and non-emergency dredging activities be scheduled to protect fish and wildlife (i.e., inwater work periods, etc.). Construction techniques to protect fish and wildlife as specified by federal and state resource agencies should be incorporated in construction contracts. Contract inspection efforts should include participation by fish and wildlife biologists. This is estimated to cost $80,000 annually over the 2-year construction period. This amount is included in the monitoring program cost detailed in Recommendation 4.

9. Existing habitats of high value to wildlife not be used as disposal sites for dredge spoils.

10. Areas of lower value to wildlife such as diked pasture and/or old dredge spoil disposal sites be used for dredge spoil disposal.

11 Herbaceous and woody vegetation be established on dredge spoil areas immediately after spoil is deposited.

12. Wetland creation in dredge spoil areas be investigated and implemented where feasible.

13. Loss of important fish and wildlife habitat due to project impacts be mitigated by development and/or improvement of other areas.

14. The property behind the Green River structure be managed for fish and wildlife and recreational uses thereof.

SPECIFIC RECOMMENDATIONS

Toutle River

It is recommended that:

1. Successful passage be provided for anadromous fish at all barriers erected to trap sediments. Passage would be required for downstream migrating juvenile salmonids and adult fish moving upstream. Planning for and final design of such mitigation facilities must be approved by the resource agencies prior to construction of any sediment retaining structure. A trap and haul facility for adults would cost an estimated $1,000,000 in addition to annual operation and maintenance costs of $100,000. Downstream passage costs are not available.

2. When feasible, a single defined stream channel be maintained in summer through impounded sediments to improve adult and juvenile fish passage.

3. A stream channel designed to permit fish passage and prevent stranding of adult and juvenile salmonids be maintained through all work areas (including the LT-1 and LT-3 dredging sites).

4. Rearing ponds be constructed to mitigate losses of Alder Creek and Deer Springs fish facilities inundated by sediment.

5. Riparian and instream habitat be improved at project cost at sites downstream of the Green River Dam to mitigate for project-related losses of instream and riparian habitat. Possible sites for riparian plantings include Disappointment, Trouble, Goat, and Dollar Creeks at a cost of about $82,000. These restoration measures should be implemented concurrently with the 2-year dam construction period. Suitable instream habitat improvement sites include, but are not limited to, the mainstem Green and South Fork Toutle Rivers, Devils and Thirteen Creeks, and at an unnamed South Fork tributary (Section Lines 22 and 23, T9N, R2E). Costs for the mainstem work would range from $60,000 to $212,000 and for the passage improvements about $100,000. The final selection of suitable mitigation measures and sites should be accomplished through a coordinated planning effort involving the Corps, affected landowners, public land management agencies, and fish and wildlife agencies.

6. Wildlife habitat within the sediment storage area upstream of the SRS be maintained as long as possible. Lands outside the sediment inundation zone, but within Corps ownership, should also be maintained for wildlife. Timber harvest should cease on this land to minimize the impact of wildlife lost gradually over the 50-year project life.

7. The LT-1 and LT-3 disposal sites be finished in irregular contours, seeded, planted to woody vegetation, and fertilized to aid in erosion control and development of wildlife habitat. Costs associated with vegetative plantings are about $98,300.

8. Periodic seeding and fertilization of the sediment inundation area with Dutch white clover, orchard grass, and red clover mix continue throughout the life of the project.

9. Elk forage such as ninebark, huckleberry, salal, and Oregon grape be planted on Corps lands outside the sediment inundation zone to replace forage lost to sediment coverage.

10. Existing herbaceous vegetation be maintained at the base of the debris avalanche. Any part of the seeded debris avalanche which is under Corps ownership should be maintained to benefit deer and elk.

11. Temporary protection of existing riparian vegetation along the Green River, North Fork Toutle River, and upper Hoffstadt Creek drainages be established to offset wildlife habitat losses within the sediment inundation zone. The major action needed would be cessation of timber harvest in the riparian zone. This protection would begin at the time of project construction and would be dropped as mitigation is implemented. Specific actions should be developed through a cooperative planning effort involving the affected landowners and fish and wildlife agencies.

Cowlitz River

It is recommended that:

1. Disposal areas be finished in irregular contours to increase habitat diversity.

2. Eroding streambanks and dredge spoil disposal areas be fertilized and revegetated immediately with herbaceous and woody plants.

3. Public access be provided to State owned or managed disposal areas.

Columbia River

It is recommended that:

1. As much bedload material as possible be kept out of the Columbia River System, and especially the estuary by:

    a. Operation of the Cowlitz River Sump;

    b. Establishment of sumps in the Columbia where there are adequate upland disposal sites.

2. In-water disposal sites for dredge spoils be located where material would not be deposited in shallow water areas or entrances to sloughs and backwaters.

3. Dredged materials be disposed of in the following sites in order of priority; 3, 1, 5, 11, 10, 2, 18, 15, 9, and 13 (Figures 16 and 17).

4. Mitigation for habitat values lost be required before use of sites 2, 9, 13, 15, 18, 19, 23, and 24. Assuming that

some of these sites are used for dredge spoil disposal, the estimated mitigation cost for this measure would range from $250,000 to $1.5 million.

5. A plan be developed under the authority of the Fish and Wildlife Coordination Act which identifies specific actions needed to mitigate for impacts of dredging and dredge material disposal. This plan should be guided by a task group of interested agencies, and should be developed to address both short- and long-term dredging needs and concerns. The plan would cost an estimated $50,000 and should be developed concurrently with detailed planning for project facilities (approximately 12 months). As the construction agency, the Corps would be responsible for implementation of mitigation measures identified through this planning process. These measures should be implemented concurrently with project dredging activities.

Please advise us of your proposed actions regarding the above recommendations. We look forward to continued coordination with you as project planning continues.

Sincerely yours,

Richard J. Myshak

Richard J. Myshak
Regional Director

JOHN SPELLMAN
Governor

WILLIAM R. WILKERSON
Director

STATE OF WASHINGTON
DEPARTMENT OF FISHERIES
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December 3, 1984

Richard J. Myshak
Regional Director
U.S. Fish and Wildlife Service
Lloyd 500 Building, Suite 1692
500 Northeast Multnomah
Portland, Oregon 97232

Dear Mr. Myshak:

Coordination Act Report - Final Draft, The Impacts on Fish and Wildlife of Proposed Sediment Control Action for the Toutle, Cowlitz and Columbia River Systems

We have reviewed your final draft Coordination Act Report (CAR) and generally agree with its contents. Your assessment of the effects of the proposed projects is adequate given the Corps of Engineers' uncertain estimates of the manner in which the sediment will be delivered from the North Fork Toutle River and the ambiguity which exists as to how the projects will affect the "recovery" of the watershed.

This most clearly demonstrates the need for general recommendations 2 - 5 which request complete monitoring of the effects of these projects during construction and after to more specifically identify mitigation measures necessary for the protection of fish and wildlife.

We concur with the remaining general recommendations as well as the specific recommendations except for Toutle River Number 6 and Cowlitz River Number 1. We do not feel the measures are necessary or feasible to implement.

Thank you for the opportunity to provide input into the earlier drafts of this CAR and to provide you with this letter of concurrence on the final report.

Sincerely,

Duane Phinney for
William R. Wilkerson
Director

cc: Keller
Mohoric
Zillges

JOHN SPELLMAN
Governor

FRANK LOCKARD
Director

STATE OF WASHINGTON
DEPARTMENT OF GAME
5405 N.E. Hazel Dell Avenue
Vancouver, Washington 98663
December 4, 1984

Richard L. Myshak, Regional Director
U. S. Fish and Wildlife Service
Lloyd 500 Building, Suite 1692
500 N. E. Multnomah Street
Portland, Oregon, 97232

RE: Final Draft -- Fish and Wildlife Coordination Act Report,
Corps of Engineers Mount St. Helens Feasibility Report

Dear Mr. Myshak:

Washington Game Department staff have reviewed the final Draft of the Coordination Act Report on the Corps of Engineers Mount St. Helens Feasibility Report.

We recognize and acknowledge the fine line between Mount St. Helens eruption related fish and wildlife impacts and Corps of Engineers action related fish and wildlife impacts. We commend you for recognizing and separating the issues to address only fish and wildlife mitigation for Corps of Engineers actions.

You state many times in the Coordination Act Report the Corps of Engineers is responsible for fish and wildlife mitigation. We object to the Corps of Engineers proposal that the State of Washington fund the O & M for fish passge or mitigation. The Corps of Engineers is responsible for fish and wildlife mitigation programs for Corps of Engineers owned and operated dams. Two examples are the Wynochee Dam on the Wynochee River and Mudd Mountain Dam on the White River in Washington State.

We concur with the findings and recommendations of the Coordination Act Report and emphasize the Corps of Engineers fund and initiate fish and wildlife mitigation planning, feasibility studies, and design schedules to coincide with other project planning phases.

Sincerely,

WASHINGTON DEPARTMENT OF GAME

Claude Stoddard

Claude Stoddard
Regional Habitat Manager

CS:pl

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506 S.W. MILL STREET, P.O. BOX 3503, PORTLAND, OREGON 97208

November 30, 1984

Mr. Richard J. Myshak
Regional Director
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Suite 1692
500 N.E. Multnomah Street
Portland, Oregon 97232

Dear Mr. Myshak:

The Oregon Department of Fish and Wildlife concurs with the draft Fish and Wildlife Coordination Act Report - The Impacts on Fish and Wildlife of Proposed Sediment Control Actions for the Toutle, Cowlitz, and Columbia River Systems.

Thank you for the opportunity to review this report.

Sincerely,

Franklin R. Young for

Michael C. Weland
Chief
Environmental Management Section

MCW:kes

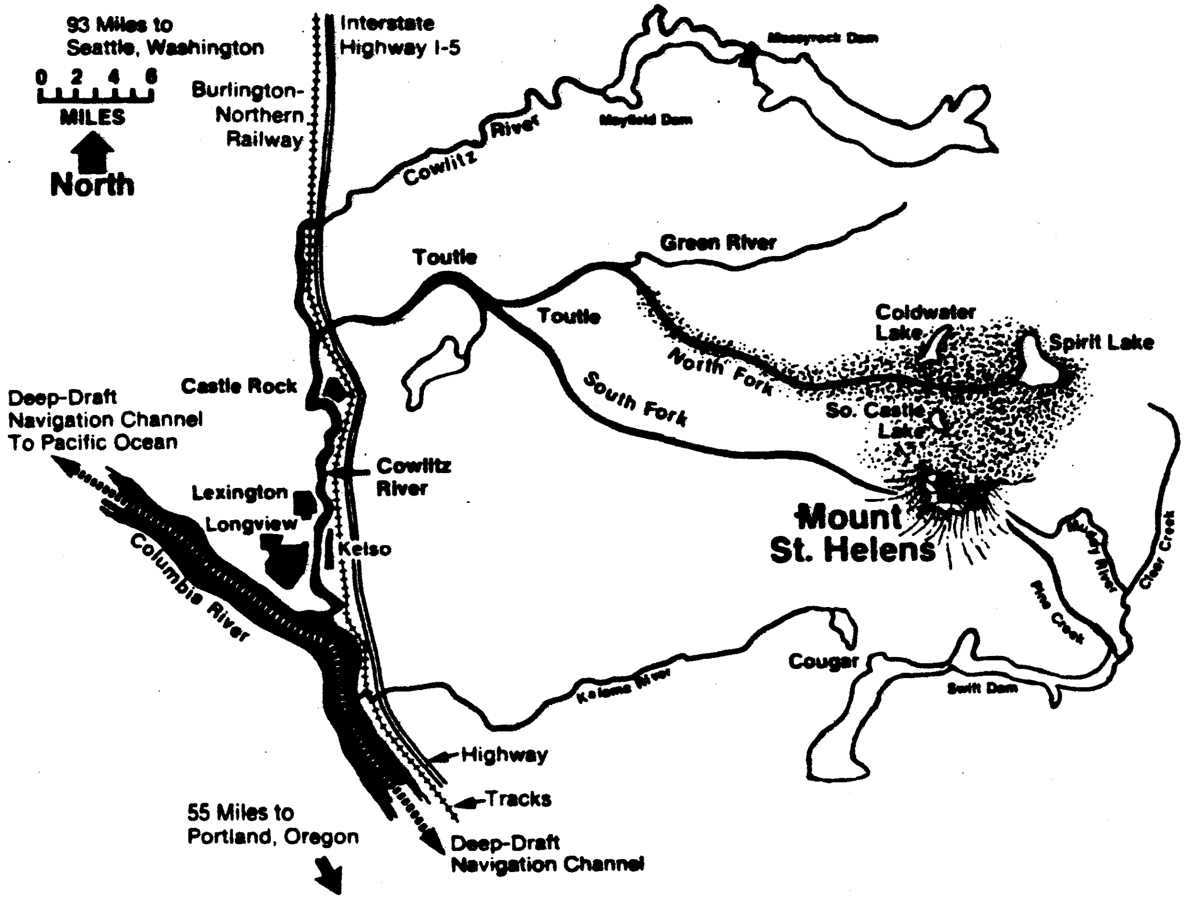
DESCRIPTION OF THE PROJECT

The eruption of Mount St. Helens in 1980 displaced an estimated 4 billion cubic yards of material from the top and center of the mountain. The resulting mud and pyroclastic flows deposited over 1 billion cubic yards of material in the Toutle, Cowlitz, and Columbia Rivers. The Cowlitz and Toutle Valleys were flooded and considerable infill occurred in the Cowlitz River. Approximately 50 million cubic yards (mcy) of material was deposited in the Columbia River, blocking the navigation channel (Figure 1). Concentrated efforts by the Corps of Engineers in the ensuing 18 months removed the blockage to the navigation channel and restored a measure of flood protection capacity to the Cowlitz River.

Approximately 3.3 billion cubic yards of material in the debris avalanche remains in the upper 14 miles of the North Fork Toutle River. It is estimated that about 650 mcy will erode and be transported by the river system. Debris avalanche yields to the North Fork Toutle River are projected to be approximately 28 mcy annually at present, dropping to 16 mcy by the year 2000 and to 7 mcy per year after 2018. Of this material 380 mcy is sand size or larger and much will be deposited in the Cowlitz and Columbia River Systems. An estimated 50 mcy of gravel and larger material will erode out of the debris avalanche and be deposited in the Toutle River and the upper Cowlitz River. The finer material (30 percent of total) will be carried in suspension into the Columbia River and much will be carried out into the Pacific Ocean. Some of the finer material will be deposited in the Columbia River estuary.

A small amount of sand size material and much of the gravel will remain in the Toutle River. Extensive channel changes in the Toutle will continue for a number of years. Approximately 74 mcy of sand size material will also be deposited in the Cowlitz, but 521 mcy will be passed through to the Columbia. The Cowlitz will reach stability in the form of a braided stream in about 50 years. Table 1 shows this process for a 40-year period.

The Corps of Engineers was requested by local, state, and federal officials to determine a long-term solution to the flooding and navigation problems posed by this material. A Comprehensive Plan for Responding to the Long-Term Threat Created by the Eruption of Mount St. Helens, Washington, was forwarded to the President of the United States on November 3, 1983. Six alternatives were considered in this plan.



The shaded portion denotes the debris avalanche.

Figure 1. Project area.

Table 1. Projected Sediment Budget for Toutle-Cowliz-Columbia River Systems, 1985 to 2024 Base Conditions (mcy) 1/

	Water Years							
	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14	2015-19	2020-24
Debris Avalanche								
Yield of Coarse 2/	5	5	5	5	5	5	5	5
Yield of Sand	66	54	43	35	27	23	20	20
Yield of Fine 3/	61	49	38	30	26	25	13	10
Green River								
Yield of Fine	5	1	0	0	0	0	0	0
South Fork								
Yield of Fine	5	1	0	0	0	0	0	0
North Fork and Toutle Erosion								
Sand	10	3	0	0	0	0	0	0
Fine	8	2	0	0	0	0	0	0
Total Yield to Cowlitz								
Coarse	5	5	5	5	5	5	5	5
Sand	76	57	43	35	27	23	20	20
Fine	79	53	38	30	26	18	13	10
Cowlitz								
Deposit of Sand and Coarse	27	21	13	6	5	5	5	5
Erosion of Sand and Coarse	0	0	0	1	5	7	10	10
Total Yield to Columbia								
Sand	54	41	35	35	32	30	30	30
Fine	79	53	37	30	26	18	13	10

1/ From Corps of Engineers.
2/ Coarse = larger than 2mm.
3/ Fine = smaller than 0.0625 mm.

In the Feasibility Study phase of this project, the Single Retention Structure (SRS) Alternative was determined to be the best means of controlling sediment yield from the debris avalanche. The Corps is evaluating SRS's at three locations on the North Fork Toutle River (Figure 2). The 14 configurations of differing spillway heights and outlet structures are summarized in Table 2. None of the three LT-3 configurations will retain all the expected bed load material. The three highest Green River configurations and the highest Kid Valley spillway height will retain all the bed load. None of the structures are being designed to retain the finer grained material (silts and clays).

Table 2. SRS Alternatives

SITE	SPILLWAY			OUTLETS	
	Width (feet)	Elevation (feet,NGVD)	Height (feet)	Type (feet)	Elevation (feet,NGVD)
LT-3	500	275	107	None	
		300	132	4-10x20	240
		330	162	"	"
Kid Valley	600	655	118	None	
		700	163	2-10x15	595
		745	208	"	"
		780	243	"	"
		855	318	"	"
Green River	600	865	77	None	
		900	112	2-5x9	820
		930	142	"	"
		965	177	"	"
		990	202	"	"
		1,060	272	"	"

The Supplemental Appropriations Act of 1983 (PL 98-63) authorized the Corps to implement and maintain flood control measures to assure 100-year flood protection for developed areas on the Cowlitz and Toutle Rivers and to reduce sediment

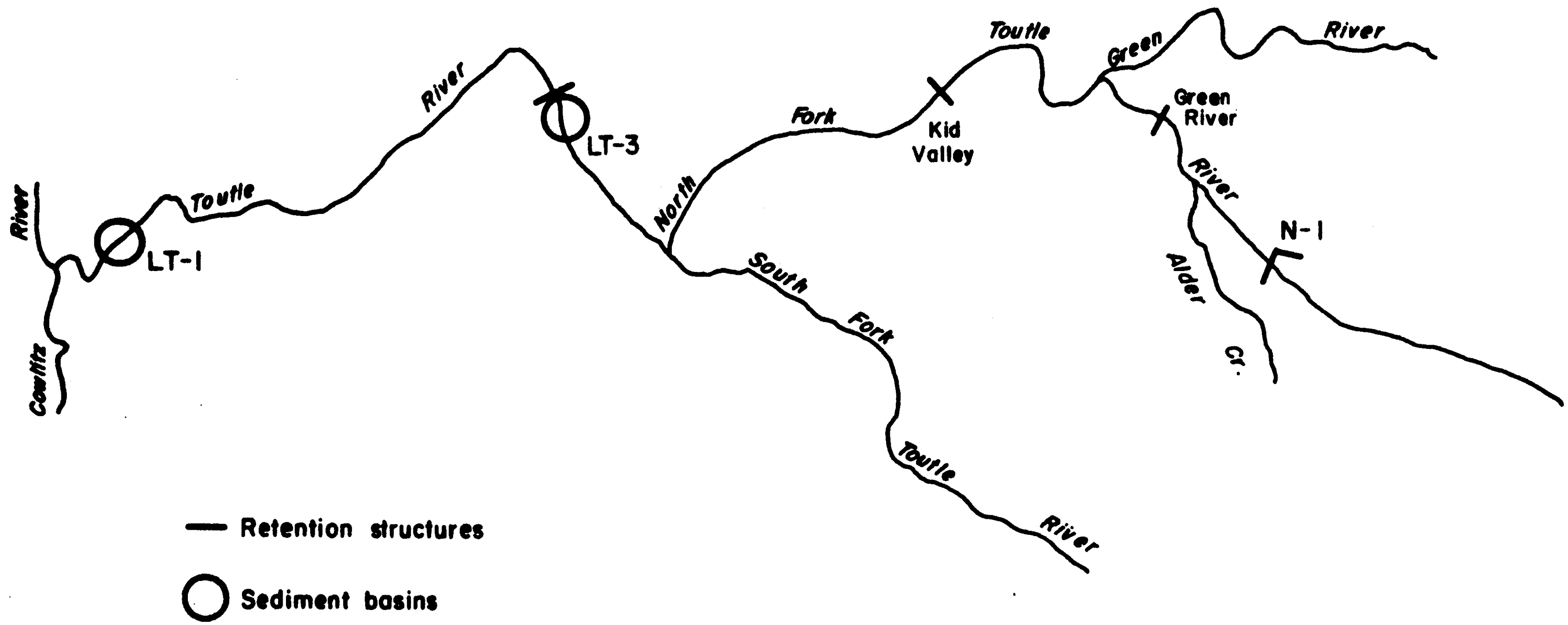


Figure 2. Sites of proposed basins and structures on the Toutle River.

flow into the Columbia River. Actions taken to date under PL 98-63 include raising of levees along the Cowlitz, dredging the Cowlitz between RM 13.5 and 20, and dredging at LT-1 on the Toutle. These actions are considered to be the base condition. Dredging will probably be used to maintain the 100-year flood protection until a SRS is operational.

A sump at the mouth of the Cowlitz has been dredged the past 3 years to prevent material from entering the Columbia River and the navigation channel. This action is expected to continue for as long as it is considered effective.

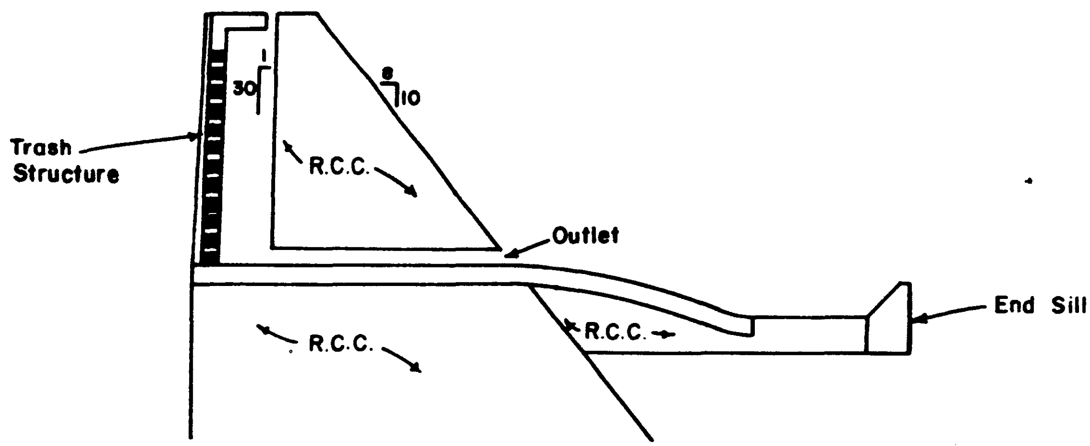
The preferred plan, which is also the National Economic Development (NED) plan, is the single retention structure at the Green River site. Also included are downstream dredging and some levee reinforcement.

The Green River Dam would have a 177-foot-high spillway. The impoundment area created would have a maximum sediment storage capacity of 411 mcy and a 50-year trapping capability of 299 mcy. This structure could store all the sediment from a 100-year frequency flood event until the year 1995 and a large mudflow event until 1991.

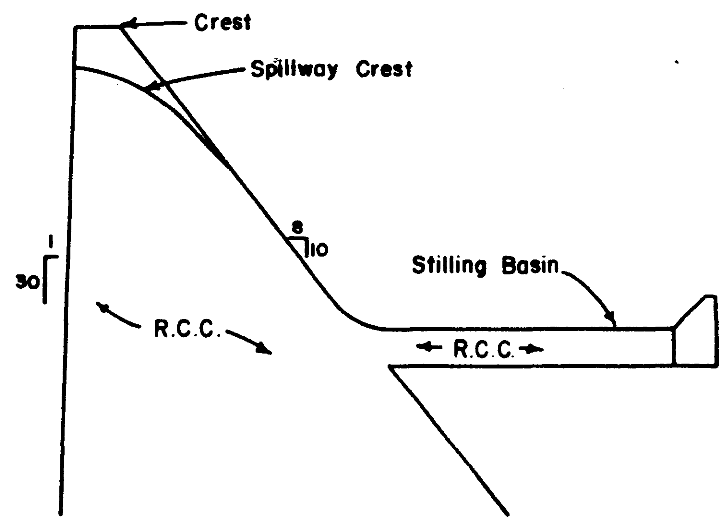
Details of the dam structure have not been finalized, but generally the structure would be a roller compacted concrete (R.C.C.) gravity dam. It would have an ungated overflow spillway 600 feet wide discharging into a stilling basin and two regulating outlets. The intakes would be part of the dam. Once the sediment reaches the level of the trash rack, stoplogs would be used incrementally to close the intakes. Figure 3 shows a schematic of the dam.

Bank protection would be provided as needed to control erosion either downstream or in the reservoir. Streambed protection would be provided for 100 feet downstream from the stilling basin and bank protection for approximately 600 feet downstream.

The Green River SRS is designed to operate with a minimum normal pool level, which would allow fines to pass through the structure. Summer water levels would be low. At times the pool would resemble a dry lake with a river flowing through it. Once the pool is filled with sediment, there would be no peak flood control and flood waters would pass directly over the spillway.



REGULATING OUTLET SECTION



SPILLWAY SECTION

Figure 3. Schematic of SRS,

An adult fish collection facility would be constructed, consisting of a water supply, holding pond, and fish trap. Provisions would also be made to pass downstream migrants through the regulating outlets.

Initially a cofferdam would be built upstream of the damsite to divert the North Fork Toutle and to act as an interim sediment structure. Dredging would continue in downstream areas until the structure is in place and most of the material already in the system below the Green River site has eroded. It is planned that 29 mcy of material would be dredged from LT-1 and LT-3 over the next 2 years. The Cowlitz sump would operate for approximately 5 years, removing 15 mcy.

It is expected that there will be localized reinforcement and repair of existing levees and riprapping to prevent excessive bank erosion.

The no-action alternative presumes that no structure will be built and that action will not be taken under PL 98-63, although the Columbia River Navigation Channel would be maintained.

Our report, while discussing other alternatives, will concentrate on evaluating the effects of the provisions of P.L. 98-63, Cowlitz sump dredging, the no action alternative, and the Green River retention structure at 177-foot spillway height.

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TOUTLE RIVER

The Toutle River Basin is typical of drainage basins on the west slopes of the Cascade Range with mountainous and heavily forested terrain. The headwaters of the Toutle River arise in steep, high elevation land with shallow to deep, well-drained soils formed of volcanic ash, glacial materials, and weathered parent rock. The mid-section of the watershed is characterized by moderate to very steep slopes on foothills. Soils in this area are deep loamy and clayey types formed from weathered parent rocks, and volcanic ash and pumice. The lower one-third of the watershed to the mouth is nearly level with strong slopes on terraces, foothills, and valleys. These are also loamy and clayey soils, but formed in alluvium (USDA 1974).

The Toutle River is a large tributary of the Cowlitz River which in turn is a major tributary of the Columbia River. The Toutle River is formed by three major tributaries. These are: the North Fork, which originates at Spirit Lake and drains the northern slopes of Mount St. Helens; the South Fork, which drains the western flank of the mountain; and the Green River, which drains forested areas north of the mountain. Before the eruption average flow in the Toutle River near its mouth was about 2,100 cubic feet per second (cfs). Maximum and minimum flows recorded were 43,200 cfs and 240 cfs respectively.

Water quality for fish life was generally good to excellent. Maximum water temperature recorded in 1979 was 68°F (USGS, 1980). The water was clear during most of the year. Higher turbidities occurred during winter freshets and in summer when hot weather melted glaciers on Mount St. Helens.

FISH

Pre-eruption

The Toutle River System provided excellent habitat for anadromous fish. Figure 4 shows the pre-eruption distribution of these fish. Anadromous fish included spring and fall chinook and coho salmon; winter and summer steelhead; and searun cutthroat trout. All species spawned naturally within the river system and used all accessible waters for spawning or rearing. Natural runs were augmented by hatchery produced fish which were stocked at several locations in the System. These migratory fish contributed to important commercial and sport fisheries in the Toutle River System, Cowlitz and Columbia Rivers, and Pacific Ocean.

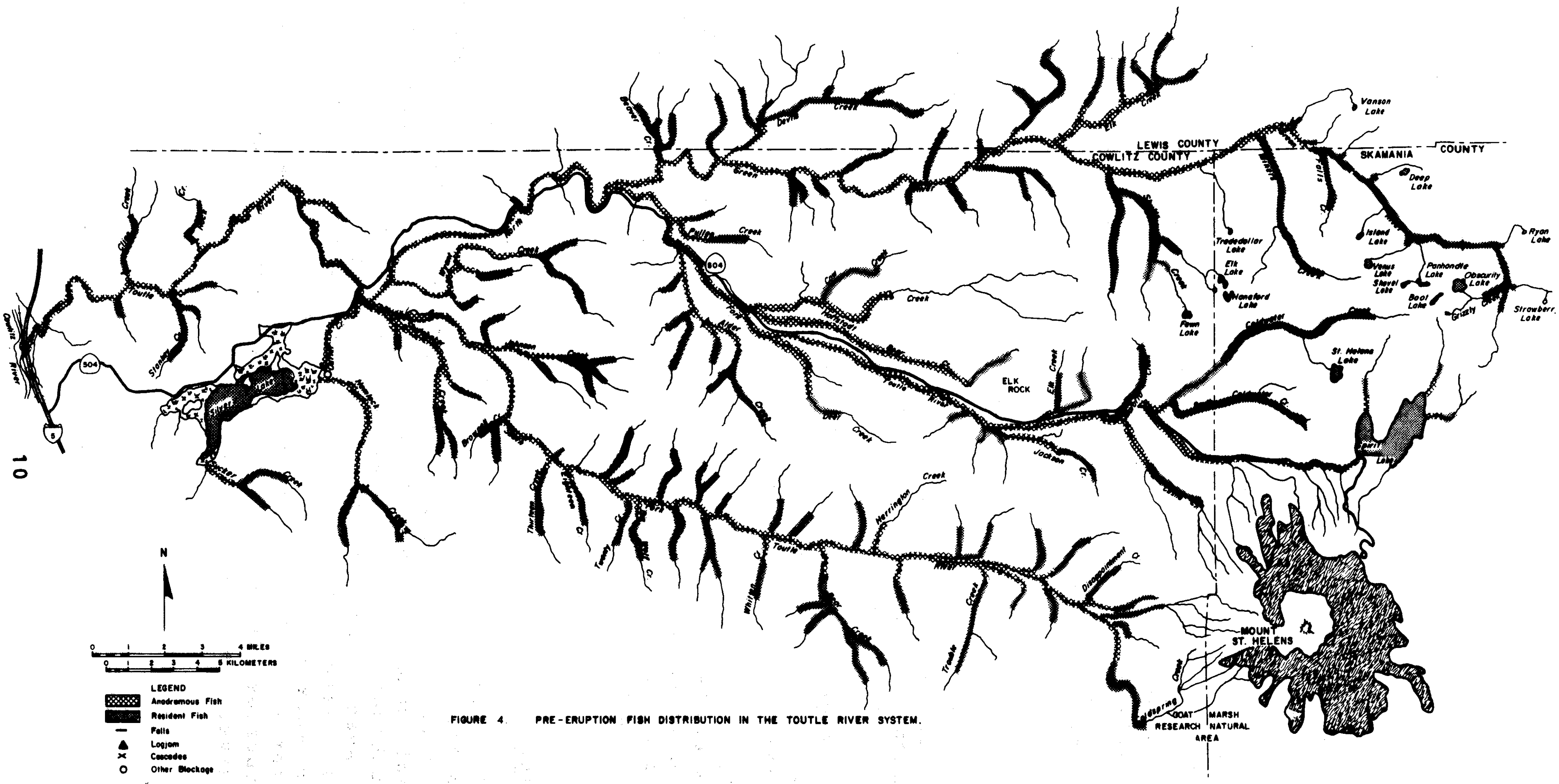


FIGURE 4. PRE-ERUPTION FISH DISTRIBUTION IN THE TOUTLE RIVER SYSTEM.

Juvenile or adult anadromous fish were present in the Toutle River throughout the year. Juveniles remained in fresh water for periods ranging from a few months to several years before migrating to sea. Upstream migrations of adult fish occurred during different months of the year, depending on the species or race. However, the times of these runs overlapped so that adult fish were in the Toutle River during all months of the year. Figure 5 shows general timing of migrations for adult and juvenile searun cutthroat, steelhead, and salmon in the Toutle River.

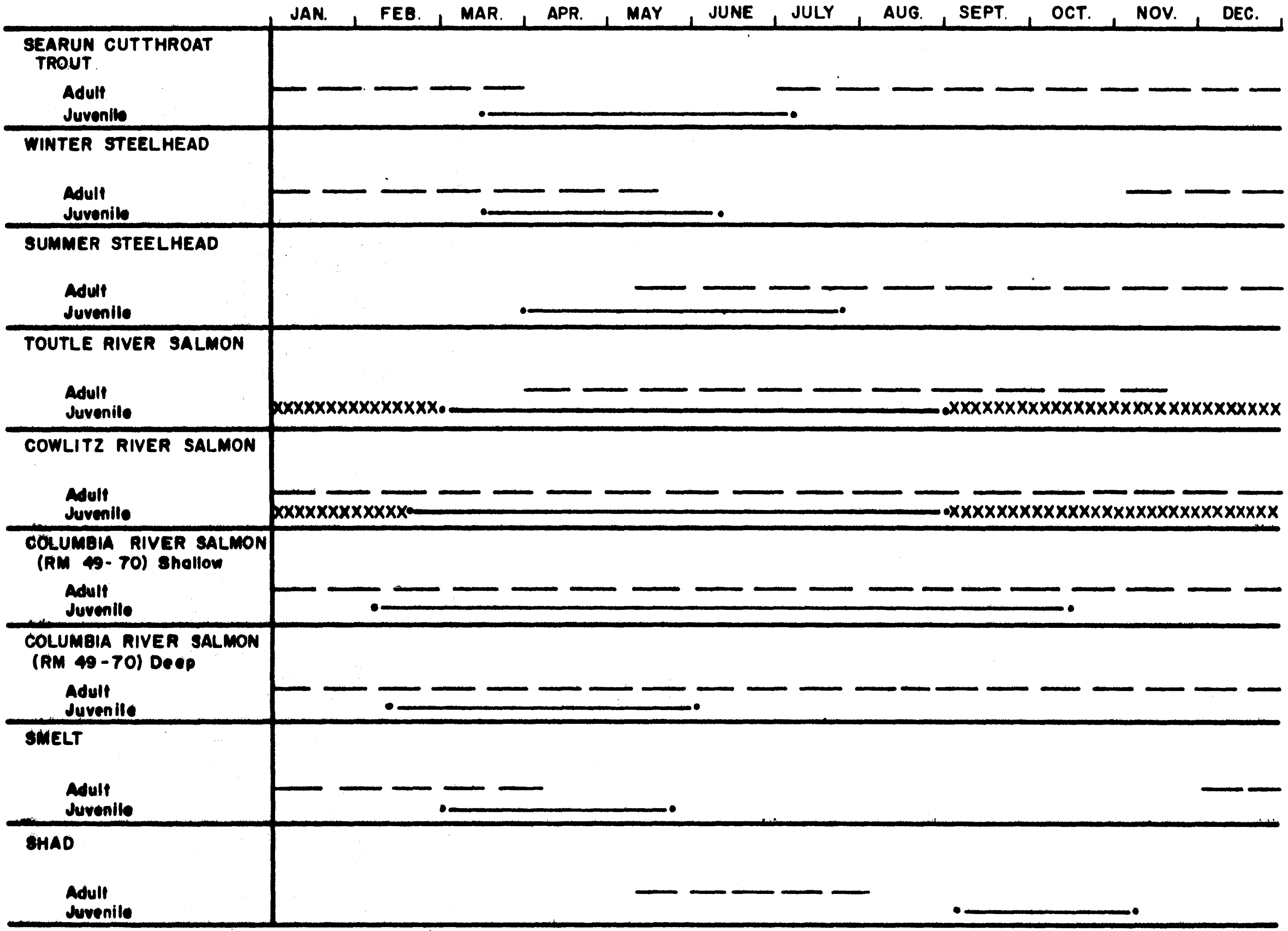
Hatchery produced fish augmented natural runs of anadromous salmonids in the Toutle River System (Table 3). Coho and fall chinook salmon were produced at the Washington Department of Fisheries Toutle Salmon Hatchery located at the mouth of the Green River. Spring chinook and some fall chinook salmon were reared at a new pond at Deer Springs and then released into the North Fork. This pond had just begun to produce larger numbers of spring chinook prior to the eruption of Mount St. Helens.

Table 3. Numbers of Salmon1/ and Steelhead Trout2/ Stocked in the Toutle River System.

Coho Salmon	1,821,300
Spring Chinook Salmon	376,500
Fall Chinook Salmon	4,542,300
Summer Steelhead	147,300
Winter Steelhead	134,000

1/ Fish stocked during 1978.
2/ Average annual numbers stocked for the period 1966 to 1980.

Steelhead trout were spawned at Washington Department of Game hatcheries outside the Toutle River watershed. Winter steelhead were spawned and raised at the Beaver Creek Hatchery on the Elochoman River. Summer steelhead were raised at the Skamania Hatchery on the north fork of the Washougal River. Some steelhead were taken to a pond at Alder Creek and reared before being released into the river. Other steelhead were reared to smolt size at the hatcheries and then stocked into the Toutle River System.



LEGEND

XXXXXXXX General presence

Migration times

Figure 5. General presence of anadromous fish in project area.

Fish from the Toutle System supported important commercial and sport fisheries (Table 4). Commercial fisheries for salmon occurred in the Pacific Ocean and lower Columbia River. Sport fishing for salmon took place in the Ocean, Columbia River, lower Cowlitz River, Toutle River, North Fork Toutle, and Green River. Steelhead were taken by fishermen in the Columbia, Cowlitz, and Toutle Rivers and its major forks.

The Toutle and Green Rivers were popular salmon angling streams. Average catches of salmon for the years 1974 through 1978 were about 500 in the Green River and 3,000 in the Toutle River.

The Toutle River supported a nationally famous sport fishery for both summer and winter run steelhead. Angling occurred throughout the mainstem and its major forks. The Toutle System usually ranked among the top five streams in Washington in total numbers of sport caught steelhead. Average catches of summer run and winter run steelhead for the years 1975 to 1979 were 3,730 and 3,380 fish respectively.

Resident fish including trout, mountain whitefish, sculpin, suckers, and peamouth chub were present in the Toutle/Cowlitz System (Figure 3). The trout supported an important sport fishery (Table 4).

There were numerous high mountain lakes in the headwaters of the Toutle River Basin. They were clear, oligotrophic lakes with good water quality characteristics. All lakes supported populations of resident trout and were periodically stocked by the Washington Department of Game (WDG). Anglers spent about 11,000 days fishing in these lakes each year. The total value of these days was about $350,000 1/ annually. About 9,000 of these angler-days valued at $285,400 1/ were spent on Spirit Lake.

Species Descriptions

The following discussion briefly describes species of anadromous and resident fish present in the Toutle River System and their use of the watershed.

1/ Based on a 1980 value of $31.71 per angler-day developed by the Washington Department of Game.

Table 4. Estimated Annual Value of Commercial and Sport Fish Produced by the Toutle and Lower Cowlitz Rivers

Species	Catch 1/	Value/Fish 2/	Total Value
Coho Salmon (Hatchery)			
Commercial	129,280	$ 8.98	$1,160,900
Sport	72,720	107.00	7,781,000
Coho Salmon (Natural)			
Commercial	17,280	8.98	155,200
Sport	9,720	107.00	1,040,000
Fall Chinook (Hatchery			
Commercial	25,600	34.80	890,900
Sport	6,400	107.00	684,800
Fall Chinook (Natural)			
Commercial	39,200	34.80	1,364,200
Sport	9,800	107.00	1,048,600
Spring Chinook (Hatchery)			
Commercial	5,160	34.80	179,600
Sport	6,840	295.00	2,017,800
Spring Chinook (Natural)			
Commercial	430	34.80	15,000
Sport	570	295.00	168,200
Steelhead	9,000	214.00	1,926,000
Searun Cutthroat	2,750	36.00 3/	99,000
Resident Trout	28,560	37.50 4/	214,100
			$18,745,300

1/ Data Sources: Salmon-Washington Department of Fisheries
Steelhead and Other Trout-Washington Department of Game

2/ Values for Salmon and Steelhead from Meyer-Zangri Associates, Inc., 1982

3/ Source: Cowlitz County, 1982

4/ Value per angler-day (Washington Department of Game, 1980)

Spring Chinook Salmon: Historically, a small population of about 400 spring chinook salmon spawned in the upper reaches of the Toutle River. Some spring chinook were also present in the Green River downstream from Devils Creek (Keller, 1982). Adult fish normally entered the river between April and June and stayed in deeper pools during the summer. Sexually mature fish spawned in late summer and early fall. Juvenile fish normally spent 1 year in fresh water before migrating to sea.

A few years prior to the eruption of Mount St. Helens, the Washington Department of Fisheries (WDF) began a program to reestablish spring chinook in the Toutle System. Spirit Lake was stocked with 418,000 fingerling from the 1976 brood year. Spring chinook were also raised to the smolt stage at the Deer Springs rearing pond and then released into the North Fork Toutle River. A few spring chinook were also stocked in the South Fork Toutle.

Fall Chinook Salmon: About 6,000 fall chinook salmon spawned naturally in larger streams and some small tributaries within the Toutle River System annually. Most spawning occurred in the North Fork of the Toutle River from the mouth as far upstream as the mouth of Coldwater Creek. Other important spawning areas were located in the mainstem Toutle River; the lower 6 miles of the South Fork; and in Wyant, Outlet, Alder, and Hoffstadt Creeks. Juvenile fall chinook normally spent several months in fresh water before migrating to the ocean.

Coho Salmon: Two stocks of coho salmon (early and late run) were present in the Toutle River System. Early run coho, which entered the river in late summer, spawned mainly in smaller streams throughout the North Fork Toutle River drainage. Some also spawned in the South Fork and mainstem Toutle Rivers and their tributaries. Some of these fish migrated into Spirit Lake and spawned in some of its tributaries. Early run coho usually spawned after the first significant fall rains. Late run "Cowlitz" stock coho entered the Toutle River during October and November. These fish spawned in tributaries of both the North and South Forks.

Juvenile coho normally spent 1 year in tributary streams before migrating to the ocean. Streams in the Toutle River System contained excellent rearing habitat for juvenile coho salmon. Sampling done by the WDF showed that Castle and Maratta Creeks were the most productive streams for juvenile coho salmon in the Columbia River System (Dammers, personal communication).

Steelhead Trout: The Toutle River supported runs of both summer and winter steelhead, a migratory rainbow trout that spawns in streams, but spends much of its life in the ocean. Originally, the winter run was the most common race of steelhead present in the System. This run returned to the river from February through May. Summer run steelhead were rare, if present at all. The Washington Department of Game began to stock hatchery produced winter and summer run fish in 1953 and 1959, respectively, to increase steelhead runs.

Steelhead spawned from February to June in the larger streams and smaller tributaries. Juvenile steelhead remained in fresh water for 2 or 3 years before reaching smolt stage and migrating to the sea. Lower reaches of many streams that were covered by the mudflow or debris avalanche contained excellent steelhead spawning and rearing habitat. Hoffstadt, Bear, Alder, and Elk (Green River tributary) Creeks were the four most important steelhead spawning streams within the Toutle River System (Lucas, personal communication).

Searun Cutthroat Trout: Searun cutthroat trout inhabited most of the river system that was accessible to anadromous fish. Adult fish were present in the system from July to April and spawned in smaller streams in winter. The spawning population of searun cutthroat was estimated to be between 2,000 and 5,000 fish.

Resident Trout: Resident cutthroat, rainbow, and brook trout were present in lakes and streams throughout the upper watershed. Most of the lakes were periodically stocked by the WDG to provide sport angling.

Eruption

The May 18, 1980 eruption of Mount St. Helens destroyed nearly all of the fish life and much of the fish habitat within the main Toutle River System. A massive debris avalanche of 3 to 4 billion cubic yards of material covered 17 miles of the upper North Fork Toutle River. About 50 mcy of material filled the upper 4 miles of the South Fork Toutle River. Spawning and rearing areas were covered with ash or mud deposits ranging from 1 foot to nearly 600 feet in depth. Snow and glacial ice that were melted by the heat of the eruption combined with the avalanche and sent enormous mudflows down the North and South Forks of the Toutle River. These mudflows continued into the mainstem Toutle, Cowlitz, and Columbia Rivers.

Hot pyroclastic flows mixing with the mudflows raised temperatures to nearly 100° F more than 20 miles from the crater (U.S. Forest Service, 1981). In the North and South Forks of the Toutle, fish died of suffocation, heat, or loss of body fluids through gill abrasion caused by the large amounts of mud and ash in the water.

Adult anadromous fish present in the Toutle and Cowlitz Rivers at the time of eruption included spring chinook salmon, and winter and summer steelhead. Incubating eggs, fry, rearing juveniles, and smolts of all anadromous salmonids were also present. Resident trout, whitefish, and nongame fish were present throughout the system.

Many streams within the blast zone received large quantities of blowdown timber and thick layers of blast deposits. In other streams, debris washouts scoured channels to bedrock. Lower reaches of many tributaries were covered by mud and debris flows which obliterated old channels and forced streams to form new courses. Mudflows also backed up into many tributaries of both forks of the Toutle River and the Green River. The least affected streams received only ashfall deposits.

Within the Toutle River Basin about 135 miles (77 percent) of the streams used by anadromous fish were affected by volcano associated events. This included all of the larger streams (about 101 miles), and 34 miles (46 percent) of the accessible tributaries (Martin, personal communication). In addition, about 62 miles of resident fish stream habitat were affected in the Toutle River Basin. Many smaller streams were only slightly affected and continued to support juvenile salmonids after the eruption.

Forests surrounding many of the mountain lakes were destroyed. However, fish life in most lakes survived because of the protective layer of snow and ice that moderated the volcano's effects. Fish did not survive in Spirit, St. Helens, Boot, and Ryan Lakes (Lucas, personal communication).

The damming effect of the mudflow and debris avalanche also enlarged Spirit Lake and formed several new lakes and ponds. Coldwater Lake (805 acres) and Castle Lake (315 acres) are the largest of the newly formed lakes. Many of the other lakes were temporary and have filled with sediment (Crawford, 1983).

Post-eruption

Fish populations and stream habitats have recovered at differing rates depending on the severity of damage suffered, locations within the Toutle River System, and rehabilitation efforts that have occurred. Habitat conditions vary from poor in severely affected streams, such as the North Fork Toutle River, to average in streams that were affected only by ashfall.

Habitat recovery has not begun in stream reaches that were covered by the debris avalanche. The North Fork Toutle River and lower reaches of Hoffstadt, Bear, Maratta, Elk, Castle, Jackson, and Coldwater Creeks are examples of streams that were buried and are seeking new channels across the avalanche (Plate 1). All of these streams are unstable with shifting, braided channels that frequently change course during storm runoff. However, the WDF, in response to a Weyerhaeuser Company fish study, has stocked 15,000 coho this year (1984) in the upper reaches of Hoffstadt Creek. The North Fork of the Toutle River is now described by the Corps of Engineers as a sand-bedded stream where sediment transport is continuous (Plate 2). Little vegetation has grown in these areas. For example, no vascular plant growth has been observed along the South Fork of Coldwater Creek since the major eruption (McKee, personal communication).

Stream recovery has occurred slowly within the blast zone. Lower reaches of many Spirit Lake tributaries have shown no sign of vegetative growth along their shorelines and less than 1 percent vegetative cover in their upper watershed (McKee, personal communication). Many streams that were covered by volcanic material are beginning to reoccupy former channels in their steeper reaches. New channels are being formed in the lower gradient portions of these streams.

Lack of vegetation along Green River tributaries within the blast zone has resulted in high stream temperatures. Little, if any, woody vegetation has regrown in the Schultz Creek drainage, an area that was denuded by the major eruption (Mohoric, personal communication). Fish have been planted in this creek by WDF (as part of the above-mentioned Weyerhaeuser study), but the survival rate is not known. WDF also planted 250,000-300,000 spring chinook fingerlings in the Green River in 1984 (Mohoric, personal comm.).

Stream habitat outside of the blast and debris avalanche zone was less affected and has recovered at a faster rate. Many

Plate 1. Bear Creek was buried by the debris avalanche and is forming a new channel.

Plate 2. The North Fork of the Toutle River is now a braided, sand-bedded stream.

stream channels covered by ashfall or mudflows have scoured down to former streambeds. These streams have reformed pools and riffles. However, instream cover such as logs, undercut banks, and boulders has not yet reestablished. Alders along banks of these streams had regrown to a height of 2.5 feet by late 1982 (Mohoric, personal communication). They have now reached 5-6 feet in height in many areas (Mohoric, personal communication).

Other streams whose lower reaches were buried by mudflows that came down both forks of the Toutle River have formed new channels across the mudflows. In most cases, the new channels are fairly straight and uniform and often run parallel to the main forks of the Toutle before entering them. Bottom substrates of these streams are composed of boulders and cobbles. Streamside vegetation is generally absent.

Among the larger streams, the Green River and South Fork of the Toutle have recovered faster than the North Fork or mainstem Toutle Rivers. The Green River, which was affected by the blast and ashfall, has been rapidly flushed of sediment. Sediment yields appear to be returning to pre-eruption levels. However, lack of riparian vegetation in the upper watershed has caused high water temperatures in much of the Green River.

The South Fork Toutle River and its tributaries have also recovered rapidly. Much of the mudflow sediment has been flushed out and riparian vegetation has begun to grow along all the tributaries (Plate 3). High stream temperatures (near 80°F) were recorded in the lower South Fork during 1981 (Schuck and Kurose, 1982).

Fish have been found in many of the waters that they inhabited before the eruption. Figure 6 shows the present distribution of anadromous and resident fish in the Toutle River System.

Limited surveys done during 1980 showed that some anadromous fish returned to the Toutle River System. Adult summer run steelhead were captured in the North Fork as far upstream as the mouth of Alder Creek by July 1980. Coho salmon were later seen in Johnson Creek, a lower South Fork tributary (Keller, 1982). Many fish are thought to have strayed to other nearby Columbia River tributaries such as the upper Cowlitz, Kalama, Lewis, Elochoman, Grays, and Washougal Rivers.

Small numbers of anadromous fish returned to the Toutle River System during 1981 and 1982. Records for the South Fork

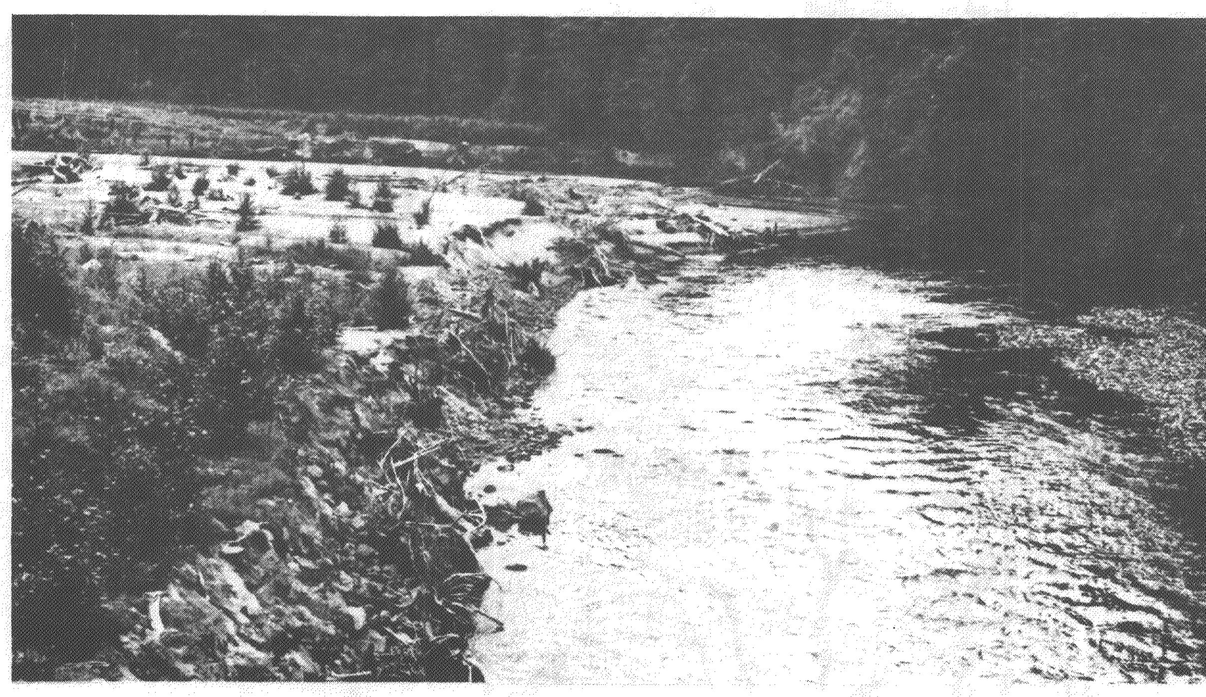


Plate 3. The South Fork of the Toutle River has flushed itself of sediment. Riparian vegetation is beginning to grow along this stream.

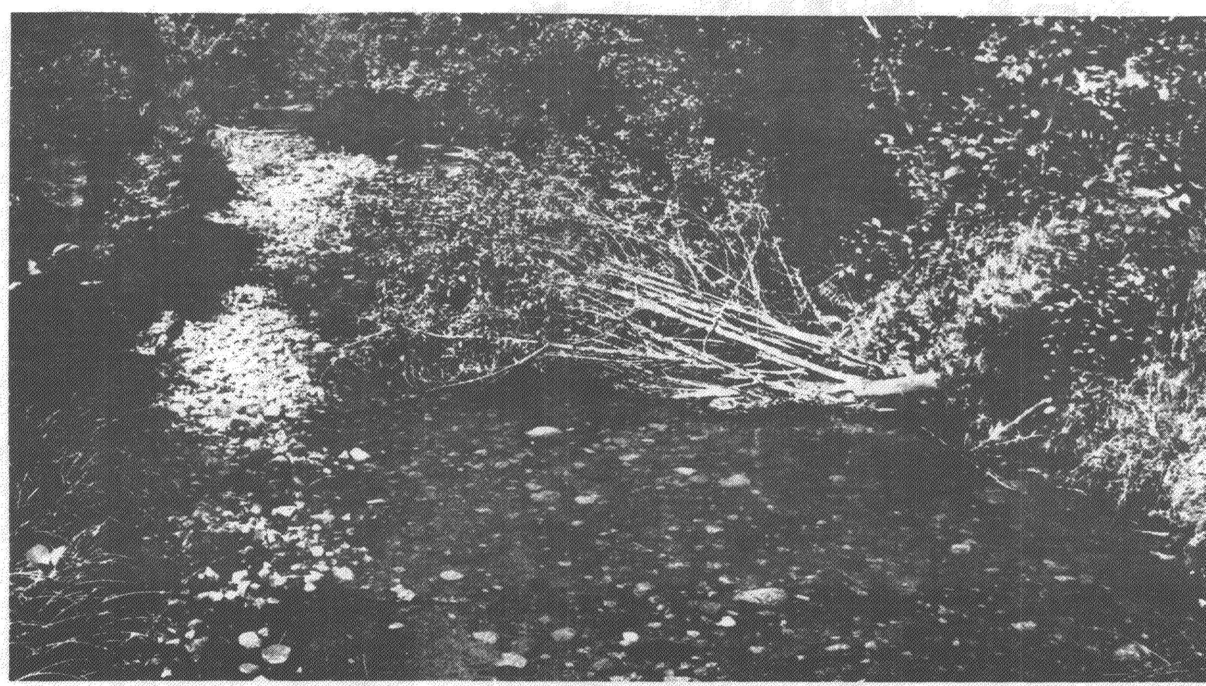


Plate 4. Alder Creek was affected by ashfall, but has recovered. Anadromous fish now use this stream.

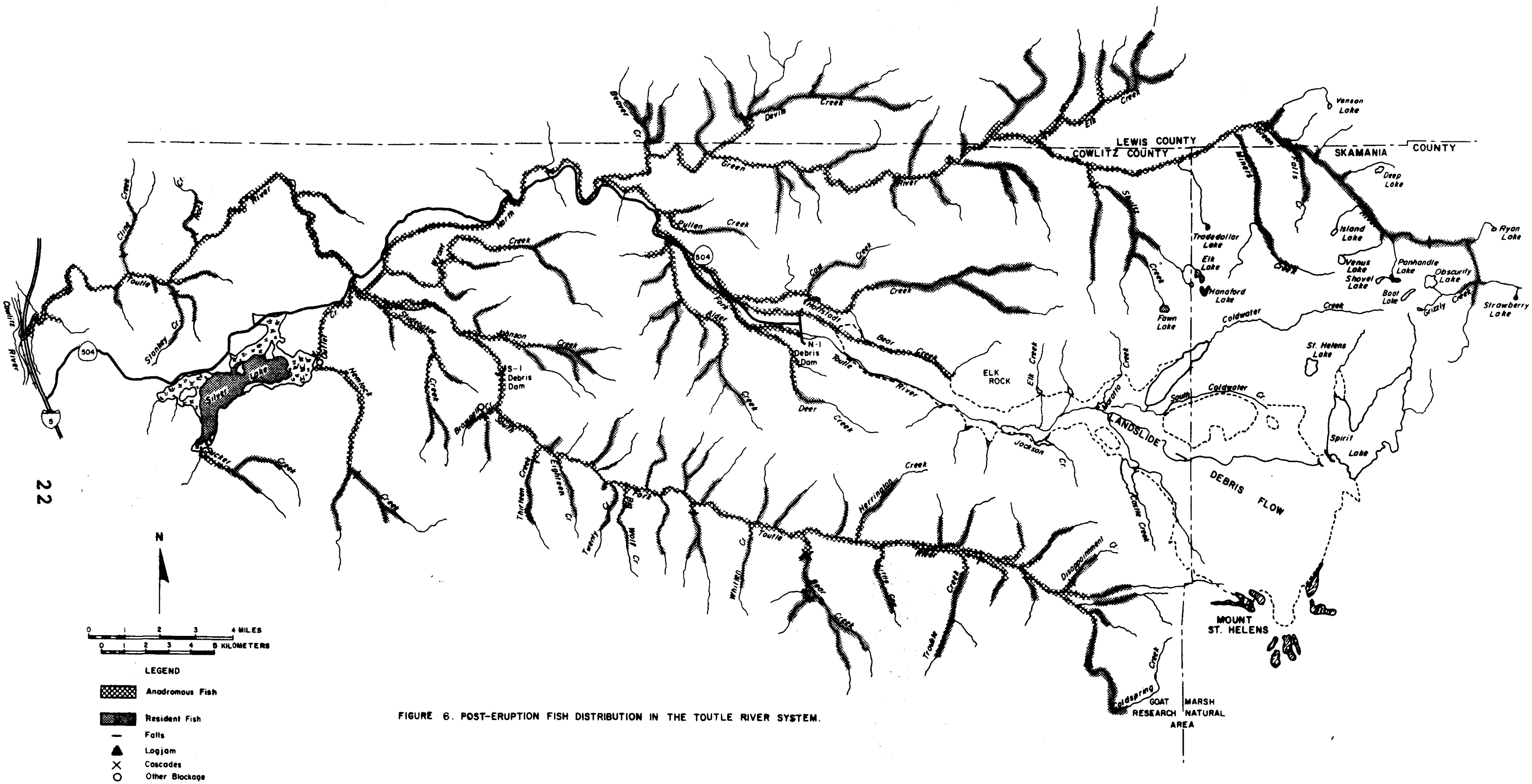


FIGURE 6. POST-ERUPTION FISH DISTRIBUTION IN THE TOUTLE RIVER SYSTEM.

Debris Retention Structure (DRS-S1) fish trap showed that fish were returning to the South Fork Toutle River. The following numbers of fish were collected in this trap between April 1981 and May 1982: Winter steelhead - 104; summer steelhead - 153; cutthroat - 15; spring chinook - 329; fall chinook - 58; and coho - 489. Most of these fish were passed over the DRS-S1. However, many of the fish that were passed in 1981 died and few spawning adults were observed. These mortalities were believed to have been caused by high water temperatures and heavy silt loads (Keller, 1982). In August 1982, spawning spring chinook salmon were seen in much of Coldspring (Goat) Creek, one of the uppermost tributaries of the South Fork (WDF, 1982).

Anadromous fish also returned to the North Fork and Green River Systems. Adult steelhead have been found in all accessible tributaries. Spring chinook and coho salmon have been observed in North Fork tributaries such as Deer, Alder, and Wyant Creeks and Green River tributaries such as Devils and Elk Creeks (Plate 4). Fall chinook have spawned in Wyant and Alder Creeks and also Outlet Creek, a mainstem Toutle River tributary (Keller, 1982).

Sampling by personnel from the WDG, WDF, and University of Washington discovered juvenile salmon, steelhead, and cutthroat in most tributaries of the Green River, South Fork, and North Fork downstream from Hoffstadt Creek. Healthy populations of juvenile salmonids have also been found in many tributaries of the South Fork Toutle River. However, densities of juvenile fish in these streams are still believed to be well below pre-eruption levels (Schuck and Kurose, 1982). Populations of juvenile fish and aquatic insects were also found to be significantly lower in sections of these streams that were affected by mudflows. Lower populations have been attributed to a lack of hiding cover, habitat diversity, and organic matter.

Future Without the Project

Without the project fish habitat in the Toutle River System would eventually recover to full pre-eruption productivity. The time required for complete recovery would depend on the severity of damage suffered by a particular waterbody, its location, and stream rehabilitation programs of fishery agencies and landowners.

Future recovery of fish habitat to pre-eruption conditions would depend on the reduction of sediment load, establishment

of riparian vegetation, and development of fish cover structures such as boulders, logs, debris jams, overhanging vegetation and undercut banks (Martin, 1982). Martin (1982) has described a likely scenario for natural recovery of severely affected streams in the Toutle Watershed, a process which would probably take 50 to 75 years for total recovery in the most severely affected streams.

Stream recovery would begin with channel pattern development and sediment load reductions which would occur within 5 to 20 years. Growth of streamside vegetation and reduced sediment loads would stabilize streambeds and banks. Streams would then form meandering channels with pools and riffles. Roots of riparian vegetation would resist channel widening and promote the development of undercut bank habitat. Trees along smaller streams would have developed a canopy within 20 to 30 years. Trees would provide shade for temperature control and leaf litter, an important energy source for aquatic invertebrates. Wind throw of trees and stream undercutting of tree roots would provide large organic debris to the stream. This debris would provide instream cover for fish and help form pools and backwaters. Fish habitat in severely damaged smaller streams would be fully recovered after 30 to 50 years. This process would require 50 to 75 years in larger streams.

Repopulation of streams by fish would occur when habitat conditions for their life stages are reestablished. This may occur before total habitat recovery occurs. Necessary conditions would include suitable water temperature and substrates, adequate hiding cover, reduced turbidity and sediment loads, available food sources, and access to streams. Figure 7 shows the expected times when streams in the Toutle River System would be suitable for fish use. The rate at which different species of anadromous fish repopulate the Toutle River System would vary because of the differing habitat requirements of each species or race. Cutthroat trout and coho salmon, which use smaller tributaries for spawning and rearing, would be expected to reestablish populations throughout the watershed first. Steelhead trout, which use both smaller tributary streams and larger rivers, would be the next species to repopulate the System. Chinook salmon, which rely primarily on habitat found in larger streams, would be the last species to recover since much of their former habitat occurred in the North Fork and mainstem Toutle Rivers. However, chinook salmon spawning has been observed in several smaller Toutle River tributaries and may continue to occur in small creeks in the future.

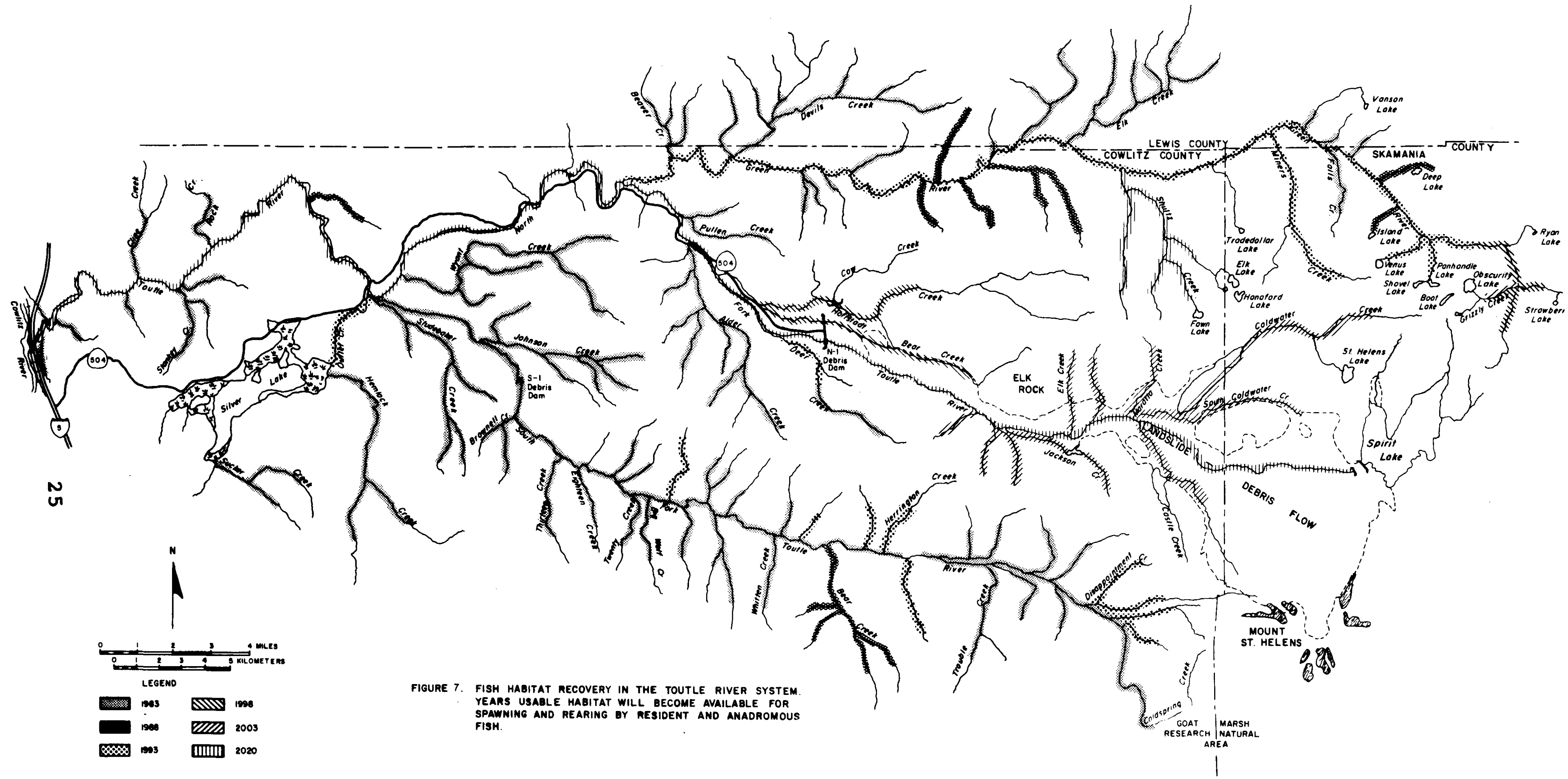


FIGURE 7. FISH HABITAT RECOVERY IN THE TOUTLE RIVER SYSTEM. YEARS USABLE HABITAT WILL BECOME AVAILABLE FOR SPAWNING AND REARING BY RESIDENT AND ANADROMOUS FISH.

In general, streams that were least affected will recover most rapidly. Substantial recovery has already taken place in many streams in the Green and South Fork Toutle River drainages.

The South Fork Toutle and most of the Green River Systems are expected to be recovered and suitable for fish by 1988 and 1993, respectively. Table 5 shows the combined numbers of adult fish expected to be naturally produced by the Green and South Fork Toutle Rivers in the future.

Table 5. Projected Annual Number and Sport/Commercial Value of Wild Adult Salmonids Produced by the Green and South Fork Toutle Rivers

	Fall Chinook	Spring Chinook	Coho	Steelhead	Cutthroat
1983					
Number	150	200	250	250	150
Value	$6,350	$27,450	$9,700	$40,150	$3,600
1988					
Number	750	700	10,000	1,040	1,600
Value	$31,750	$96,150	$387,400	$166,900	$38,400
1993					
Number	850	700	12,000	1,040	1,600
Value	$36,000	$96,150	$464,850	$166,900	$38,400

Streams within the North Fork Toutle River Basin upstream from the mouth of the Green River are also recovering at varying rates. Two streams, Alder and Pullen Creeks, were not severely impacted and are now at pre-eruption conditions.

Tributaries that were covered by the debris avalanche and mudflow would require more time to recover because they would have to establish stable new channels and riparian vegetation. Formation of permanent channels would not begin until sediment yield from the debris avalanche has stabilized. Streams at the lower end of the debris avalanche such as Hoffstadt, Bear, and Deer Creeks would not be usable by substantial numbers of fish until 1998. Fish habitat in

severely affected streams higher in the debris avalanche would not be restored until 2003, while the North Fork Toutle would not be usable for spawning or rearing until 2020. Total recovery of these streams would require between 50 and 75 years from the date of the eruption. These streams include Maratta, Castle, Coldwater, Elk, and Jackson Creeks.

The North Fork and mainstem Toutle Rivers would show substantial recovery after 35 years when the debris avalanche becomes stabilized. Complete recovery of these rivers would require an additional 15 to 40 years.

Fish stocks in the North Fork Toutle drainage are presently at a very low level. Populations of all species would gradually increase during the next 15 years as habitat conditions improve in various tributaries. Full production should be realized by 2020 when all streams have shown substantial recovery. Recovery rates for fish populations in the upper North Fork and their associated monetary values are shown on Table 6. Methods and calculations used to develop these predictions are shown in Appendix A.

The Washington Departments of Game and Fisheries plan to reintroduce anadromous fish into the Toutle River System as streams become suitable. The South Fork was stocked with steelhead in 1981, 1982, 1983, and 1984; the North Fork in 1982; and the Green in 1982, 1983, and 1984. The Green River and South Fork Toutle and their tributaries were stocked with coho and spring chinook salmon in 1983 and 1984. Both river systems would continue to be stocked with salmon and steelhead in the future. The WDF has also stocked coho salmon in Alder Creek, a North Fork tributary. Spring chinook would be stocked in Beaver Slough (on the Green River) in the spring of 1985.

Future With the Project

No Action

About 400 mcy of bedload and 200 mcy of suspended load would enter the Columbia River over a 50-year period. About 50 mcy of gravel would remain in the Toutle River. Over the long-term, slow recovery of stream habitat in the Toutle and North Fork Toutle River Systems would occur. Reestablishment of accessible habitat, including riparian vegetation, would mean the return of anadromous fish runs and the opportunity to provide for enhancement of these fish through natural or hatchery production. Prolonged turbidity and continued

Table 6. Projected Annual Number and Sport and Commercial Value of Wild Adult Salmonids Produced by the North Fork Toutle River System Upstream from the Mouth of the Green River

	Fall Chinook	Spring Chinook	Coho	Steelhead	Cutthroat
1983					
Number	50	20	100	50	50
Value	$2,100	$2,740	$3,850	$8,025	$1,200
1988					
Number	75	50	150	150	250
Value	$3,150	$6,850	$5,775	$24,075	$6,000
1993					
Number	125	150	650	250	400
Value	$5,250	$20,500	$25,025	$40,125	$9,600
1998					
Number	2,000	200	1,030	450	600
Value	$84,000	$27,450	$39,650	$72,225	$14,400
2020					
Number	15,800	500	18,900	2,050	2,800
Value	$663,600	$68,500	$727,650	$329,025	$67,200

channel changes and streambank instability, however, would reduce the survival rate and successful spawning of adult salmonids for many years. Little or no sport fishery would occur in the North Fork Toutle River, even after habitat recovery.

No Action With Interim Measures (Public Law 98-63)

This alternative is basically a non-structural alternative. Dredging would occur at two sites, LT-1 and LT-3 (Figure 2) to satisfy the PL 98-63 requirements to maintain a 100-year flood plain. If no structures are built, dredging would be continuous over a period of 8 years with reduced dredging for

the next 25 years. If an upstream dam is constructed, dredging at the LT-1 and LT-3 sites would continue, but at a reduced level.

Only 50 to 80 percent of bedload material would be trapped and removed with this alternative. The remaining material and all suspended load would pass through to the Cowlitz and Columbia Rivers. A significant problem associated with this alternative is the need for long-term disposal sites. Approximately 29 mcy of material would require disposal, much of which would be placed on valuable wetland riparian habitat. Problems with fish passage at the interim dredging sites would also be experienced. The beneficial aspects of this alternative, i.e. reduction in sedimentation and maintenance of passage for anadromous fish to upstream tributaries, are outweighed by the negative impacts on fish habitat from continued dredging and loss of riparian/wetland habitat.

Multiple Retention Structures (MRS)

This alternative involves structures (at the LT-3, Kid Valley, and Green River sites, (Figure 2) which would be constructed at varying times over the next 10 years. The LT-3 Dam would be constructed first and the Green River Dam last. The lowermost dam at LT-3 would effectively eliminate nearly all of the Toutle River System's existing and potential anadromous fish production. Construction of each succeeding structure (Kid Valley and Green River Dams) would result in further destruction of fish habitat. Sediment and debris accumulating behind each dam as it is constructed would back up into tributary streams and block any potential anadromous fish migration, instream food production, and development of riparian vegetation. Resident fish would also be adversely affected by this blockage.

Single Retention Structure (SRS)

A single dam placed at any of the above sites would have similar impacts. Each of the single retention structures is discussed in more detail below:

LT-3 Site: This alternative (elevation 330) would reduce sedimentation in the Toutle River downstream of the structure until the impoundment area was filled (in about 4 to 5 years). Downstream water turbidity would improve during this period, as would spawning and rearing of fish in the lower Toutle River. But once the LT-3 impoundment area was filled, this advantage would be eliminated.

Summer water temperatures in the Toutle River could be elevated by the increased retention time of shallow water behind the dam. Retention time of greater than 30 days is considered critical to downstream water quality. Preliminary figures indicate that surface water temperature of the impounded pool during June to October would be 1 to 2 degrees higher than the inflow temperature. Depending on the mode of release of this water, downstream water temperatures could be adversely effected.

Anadromous fish production valued at about $2,661,000 annually would be eliminated permanently from all waters upstream of this structure. Existing and potential fish habitat for anadromous and resident fish in portions of the Toutle River and many of its major tributaries would be covered with sediment. Sediment buildup behind this structure would impact as much as 2,250 acres (Table 7).

Table 7. Sediment pool sizes with alternative sites and elevations.

SITE	SLOPE	ELEVATION	ACRES
LT-3	S=0.004	275	1,040
	S/2=0.002	300	1,700
		330	2,250
Kid Valley	S=0.008	665	590
	S/2=0.004	700	1,400
		745	2,240
		780	3,240
		855	5,775
Green River	S=0.012	865	860
	S/2=0.006	900	2,012
		930	2,950
		965	3,825
		990	4,291
		1,060	5,560

Kid Valley Site: The effects of this alternative on downstream water quality and water temperatures are similar to those described for the LT-3 site. The shallow pool behind this structure is projected to be 3 degrees warmer than the inflow temperature in August. The 64°F projected temperature

approaches the upper limit established by Washington State law. Releases from the dam could, therefore, negatively impact mainstem Toutle waters.

Anadromous fish passage to the Green and upper North Fork Toutle Rivers would be blocked. The value of this annual fish loss is approximately $2,260,000. The option to re-open the Toutle Salmon Hatchery on the Green River would be foregone. This would mean a loss in production of approximately 6 million coho and fall chinook salmon fry. Sediment deposition in the Green and upper North Fork Toutle Rivers would block access to the upstream fish habitat in these rivers. Sediment deposits upstream of this structure would cover 2,240 acres (Table 7).

Green River Site (Preferred Alternative): Future sedimentation in the North Fork Toutle River downstream of the dam would be reduced by about 299 million cubic yards within 50 years after completion of construction. Opportunities to fish for salmon and steelhead in downstream areas would be restored sooner and in a greater number of sites with this alternative than with a dam located at the LT-3 or Kid Valley sites. As a result of reduced sedimentation and controlled flows, riparian vegetation would reestablish sooner along the lower portion of the North Fork and mainstem Toutle River than with either the LT-3 or Kid Valley sites or the no action alternative. These latter effects would help significantly to reestablish salmonid fish runs in areas downstream of the dam. Depending on future habitat restoration, salmonid fish runs supporting an annual catch of 335,000 valued at about $18,500,000 annually would eventually return to the Toutle and lower Cowlitz Rivers. However, there are no specific data to confirm when the areas downstream of the dam would recover enough to support such populations.

Anadromous fish runs in the upper North Fork Toutle River, and in its major tributaries such as Alder, Pullen, Deer, Hoffstadt, and Bear Creeks would be eliminated for many decades under this alternative (Figure 8). The area impacted by sediment deposits amounts to about 3,825 acres (Table 7). Salmon and steelhead would also be prevented from reestablishing in Spirit Lake and its tributaries because of the lake's outlet tunnel. Fish losses in Spirit Lake are considered to be offset by downstream benefits of the Spirit Lake project but, due to the tunnel location, an additional 5 miles of the North Fork Toutle, valued at $259,000 annually, would be eliminated. Annual losses for anadromous fish equate to about $1,858,000. Resident trout populations and habitat upstream of the dam would also be severely depressed in many of the upper North Fork Toutle River tributaries. Opportunities for angling upstream of the dam would also be foregone.

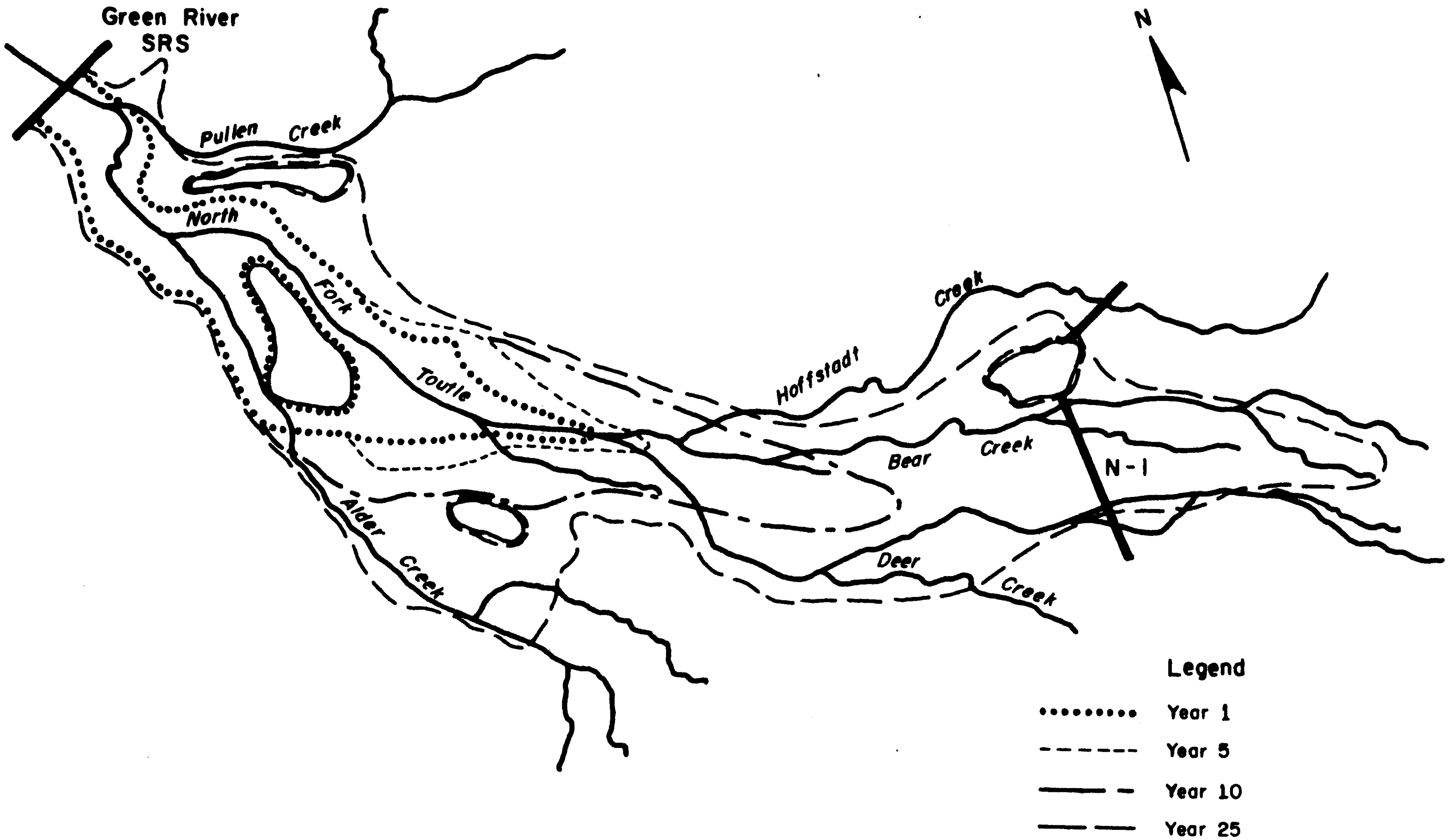


Figure 8. Sediment accumulation upstream of the Green River SRS.

The release of warm ponded surface water from behind the dam could adversely effect water temperatures downstream of the dam. Data indicate that for the Green River dam, retention time would not exceed 20 days. However, surface water temperatures would rise as much as 6 degrees over inflow temperatures to a high of 67°F in August. This temperature is above the maximum limit established by Washington State law. If this temperature effect was carried downstream any significant distance, it could interfere with returning fish runs, thus negating some of the benefits resulting from reduced sedimentation in the North Fork Toutle River. Of the structural alternatives, however, the Green River site offers the best opportunity to reduce or prevent downstream sedimentation and restore fish runs to the major portions of the Toutle River System.

WILDLIFE

Pre-eruption

Habitat

Almost all lands in the Toutle River Basin System, with the exception of the volcano, supported forest vegetation from seedlings to stands over 400 years old. These forests were primarily coniferous. Above 3,500 feet the forests were characterized as Pacific silver fir type with Douglas-fir, western hemlock, western red cedar, noble fir, subalpine fir, mountain hemlock, and lodgepole pine as common associates. Members of the heath family including huckleberry, fool's huckleberry and salal were the primary understory species. Below 3,500 feet the climax species were western hemlock and western red cedar. Understory species included vine maple, huckleberry, salal, sword fern and devil's club. Hardwood species were concentrated along larger streams, creeks and rivers. The most common species were alder, maple, willow and cottonwood (USFS 1981). Overall, hardwoods did not comprise a significant percentage of total forest species in the area.

Most wetlands along the Toutle River occurred in areas where the stream formed multiple channels, most of which carried significant discharges only at high flows (Meyer, personal communication).

According to the National Wetlands Inventory (U.S. Fish and Wildlife Service), most wetlands in the upper basin were classified as riverine. A few small and isolated palustrine and lacustrine areas also occurred in the area. Spirit Lake

was the only large lacustrine wetland in the area. Near the confluence of the North and South Forks, palustrine wetlands in close proximity to the river increased in abundance. A lacustrine wetland (Silver Lake) with a palustrine fringe was located on a lower tributary to the Toutle River.

The primary land use for the Toutle Basin was (and remains) commercial forest. A small portion of the watershed, near the headwaters of the system, is within the Gifford Pinchot National Forest. The majority of the watershed is corporately owned land with scattered state-owned tracts. The lower portion of the watershed is primarily in private ownership (USDA 1974).

Wildlife

Black-tailed deer and Roosevelt elk were the most common big game species in the Toutle River Basin. The upper portion of the basin was an important wintering area. Wintering areas were located primarily along the Green River (beginning just outside Forest Service boundaries) and along the North Fork of the Toutle River (USFS, 1981). The South Fork was of lesser importance as a wintering area, possibly because of the narrower flood plain (Kuttel, personal communication; WDG, 1978). Washington Department of Game (1980) records indicate an average of 1,250 elk and 2,700 deer had been harvested annually from the blast zone during several seasons preceding the blast.

A small population of mountain goat had been introduced into the Mt. Margaret back country in 1972 and 1973. In 1978 the population was estimated to be about 15 animals (WDG, 1978).

Black bear and cougar were also present within the Toutle River Basin (Cowlitz County, 1982). Washington Department of Game (1975) and Forest Service (1981) records indicate both of these species had sufficient populations to support recreational hunting.

The diverse habitat types in the Basin supported a wide variety of furbearers and small mammals. The more common species are listed in Table 8. One rather unusual species, the Cascade red fox, occurred within the study area (WDG,1979). This species ranges throughout the Cascade Mountains, occupying open forested habitat near the timberline.

Table 8. Common Species of Small Mammals and Furbearers Found in the Toutle River System.

Common Name	
Opossum	Muskrat
Shrews	Pacific jumping mouse
Moles	Porcupine
Bats	Red fox
Pika	Coyote
Snowshoe hare	Raccoon
Mountain beaver	Marten
Hoary marmot	Fisher
Townsend chipmunk	Mink
Western gray squirrel	Long-tailed weasel
Douglas squirrel	Ermine
Northern flying squirrel	Striped skunk
Beaver	Spotted skunk
Mice	River otter
Dusky-footed wood rat	Bobcat
Voles	

The Toutle River Basin was not considered to be an important waterfowl area. As a result, specific waterfowl use information is lacking. No known surveys were conducted in years directly preceeding the blast. More common species which may have used the basin include mallard, American wigeon, teal, and merganser.

Upland game birds found in the area included ruffed and blue grouse (USFS, 1981). Ruffed grouse usually occur in deciduous forest or mixed deciduous and coniferous forests characterized by variations in successional stages with nearby clearcuts or fields (Brewer, 1980). Blue grouse are common in more mountainous areas in association with coniferous forests, clearcuts, brush, and meadows.

Birds of prey which occurred within the project area include spotted owl, barred owl, western screech-owl, northern saw-whet owl, great horned owl, red-tailed hawk, sharp-shinned hawk, Cooper's hawk, goshawk, kestrel, merlin, osprey, and bald eagle (USFS, 1981). Spotted owl habitat occurred along the upper Green River watershed in old growth stands near Goat Mountain (USFS, 1981). Bald eagle and osprey nested along Spirit Lake (Roberts, personal communication).

The diverse habitat types within the Toutle River Basin supported a wide variety of bird species. A small population of white-tailed ptarmigan occurred above timberline on Mount St. Helens (Roberts, personal communication). Woodpeckers, such as downy, hairy, black-backed, and three-toed; and other cavity excavators such as the red-breasted sapsucker and the red-breasted nuthatch occurred throughout old growth and snag areas. Riparian and upland sites provided habitat for a wide variety of passerines and other songbirds including sparrows, finches, warblers, swallows, swifts, vireos, thrushes, wrens, blackbirds, jays, chickadees, nuthatches, crows, ravens, and hummingbirds (USFS, 1981).

Eruption

The blast of the Mount St. Helens eruption was directed in a 120° arc on the north to northeast side of the mountain. The force of the explosion and hot gases completely destroyed all forests for a radius of 8 miles from the mountain. For another 5 miles outside of this zone, old growth was uprooted and knocked down; smaller vegetation was killed. Outside this zone, up to a distance of 20 miles from the volcano, hot air and gases killed the vegetation (Cowlitz County, 1982). The upper portion of the watershed was blanketed with 1 to 4 inches of ash and tephra.

The loss of old growth habitat (along the Green River) was probably the most serious long-term damage to wildlife habitat resulting from the blast. It was particularly damaging to the spotted owl, although a wide variety of avian and mammalian species also utilized this habitat.

Deer and elk winter range along the North Fork and along the Green River was heavily impacted by the eruption and associated mudflows (USFS, 1981). Riparian vegetation, particularly understory species, was damaged by the mechanical force of the mudflow and by burial. Vine maple was the most heavily impacted, followed by Western red cedar, red alder, and Western hemlock (Chapman, 1981). All of these species have high palatability for elk (Murie, 1951).

It was assumed that all wildlife within the blast zone died. The Washington Department of Game (1980) estimated that approximately 5,000 elk and 6,000 deer were killed as a result of the eruption. The entire mountain goat population was destroyed. Approximately 200 bear and 15 cougars were killed. Some burrowing mammals probably survived in portions of the blast zone beyond the areas of complete devastation.

The white-tailed ptarmigan population was probably destroyed (USFS, 1981).

Furbearer and upland game losses estimated by the Washington Department of Game are shown in Table 9.

Songbirds appeared to be particularly affected by the blast. Ashfall accounted for a number of problems including respiratory distress, reduced food sources (insects in particular), and lowered nesting success (USFS, 1981).

Table 9. Estimated Furbearer and Upland Game Losses in the Toutle River System (WDG, 1980).

Species	No. of Animals
Beaver	1,016
Muskrat	2,714
Otter	186
Mink	504
Coyote	1,411
Raccoon	1,181
Marten	710
Bobcat	300
Rabbit/Hare	11,300
Grouse	27,750
Pigeon	8,500

Post-Eruption

Habitat

A wide variety of habitat conditions exist within the watershed. Some areas were severely impacted and in some cases vegetation was completely destroyed. Other areas were relatively unaffected by the blast. Existing habitat types at the proposed SRS are shown in Figure 9. Extensive natural and artificial revegetation is occurring in areas affected by the blast and associated mudflows. Generally, vegetation recovery has been vigorous, a situation which is apparently not unusual at volcanic sites (Nichols, 1963, cited by FS, 1981; Anderson, personal communication).

Areas impacted by debris flow, pyroclastic flows, or steaming mudflows were completely destroyed and have not yet

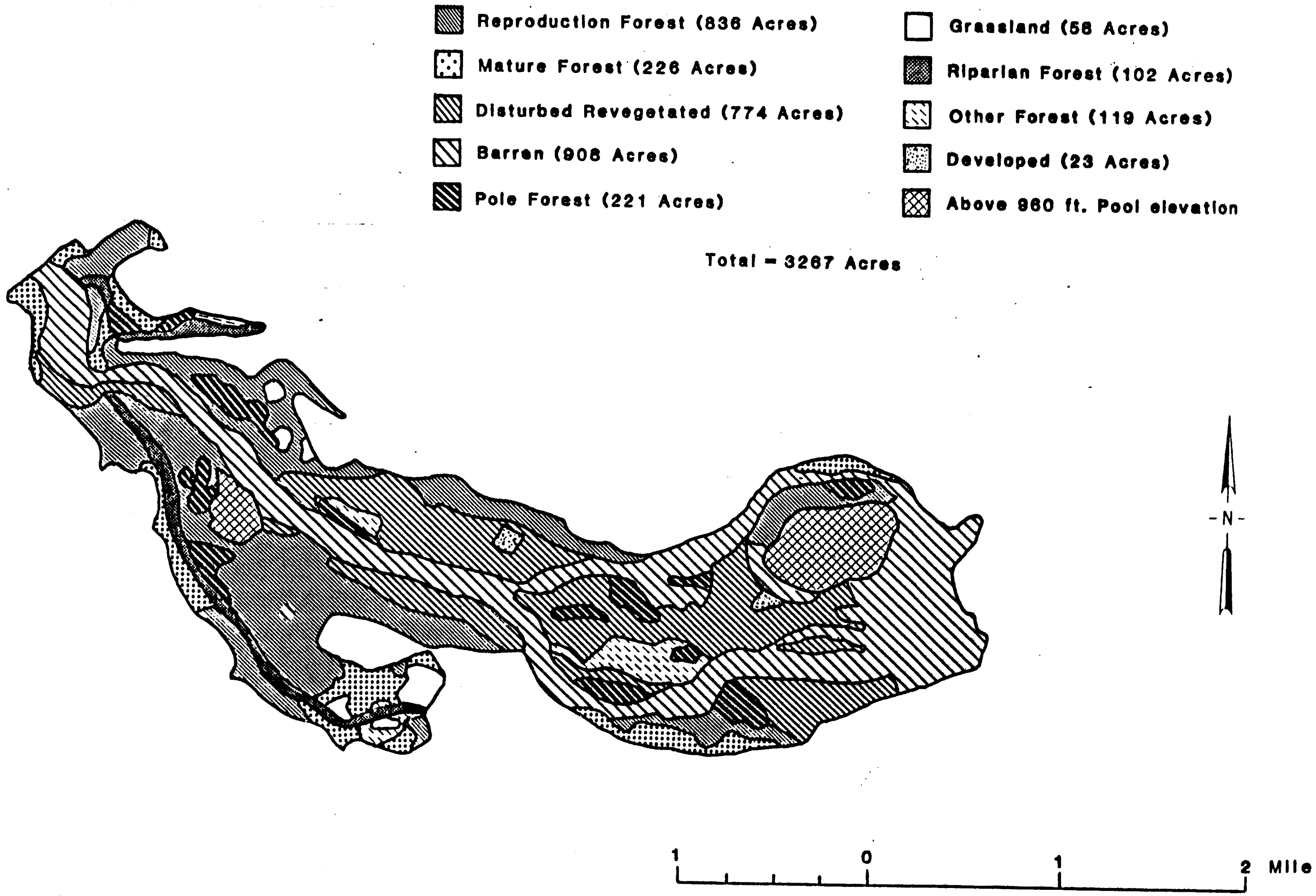


Figure 9. Post-eruption Habitat Types at Green River Site.

recolonized. Pyroclastic materials are very low in nitrogen, phosphorus, and major cations. Soil cooling, in situ nitrification, importation of nutrients (i.e. pollen, detritus, anthropods) and long distance seed dispersal will be needed in order for recolonization to occur.

Regions which received direct heat blast also suffered high plant mortality. Soil development, erosion of tephra, and recovery of residual plants and seedling establishment are needed for colonization. Because nitrogen levels are low, lupine are likely to be the most successful colonists.

In thick mudflows, vegetation was buried and destroyed. However, in cool mudflows, rootstocks survived and sprouted if not too deeply covered. In some areas erosion has uncovered original soil surfaces allowing existing plant species to survive or permitting new colonization (Del Moral, 1983).

Early natural revegetation (i.e., 1980) was mostly from the sprouting of top-killed vegetation (the ash layer prevented species highly dependent on seed propagation from becoming established). Bracken fern, fireweed, and Canadian thistle shoots began appearing in June 1980 (Stevens et al., in press). By October 1981, 31 species (approximately one-third the pre-blast number) were recorded in test plots within the blast area (Stevens, et al., in press; Means, et al., in press). Plant coverage had doubled by this time, with some native species sprouting from seed. Grasses, Canadian thistle, clover, trailing blackberry, bracken fern, Oregon grape, fireweed, pearly everlasting, thimbleberry and false dandelion (in decreasing order) had the greatest relative frequencies in clearcut test plots in the Green River Basin. In general, clearcut areas showed significantly greater plant cover in the 2 years following the eruption compared to blowdown areas (Means et al., in press).

By 1983, 230 species were recorded growing around the mountain; compared to 300 prior to the eruption (Chicago Tribune, 1983). Noble fir has shown an unexpectedly large increase in the number of seedlings.

Artificial revegetation has had and will continue to have an important influence on the recovery of vegetation in the watershed. Conifer planting on state and private lands was begun in the winter of 1981 and by the end of 1982 approximately 19,000 acres were planted (Anderson, personal communication). The bulk of this planting has been in the area between the North Fork of the Toutle and Green Rivers.

This area had little or no vegetation following the blast. In 1983, approximately 12,000 acres were planted by Weyerhaeuser Company in the lower Green River, Miners Creek, and south slopes along the North Fork of the Toutle River. In 1984, an additional 9,000 acres were planted between upper Hoffstadt Creek and the Green River, the south slope of the upper Green River, and between the North and South Forks of the Toutle River (Stevens, personal communication). Weyerhaeuser Company plans to plant another 9,000 acres in the near future.

Douglas-fir was planted at elevations below 3,000 feet and noble and silver fir at higher elevations (Anderson, personal communication). Hardwood species were also planted, but primarily in riparian zones and in mudflows. Approximately 45 miles of streambank was scheduled to be planted by the end of 1982 (Anderson, personal communication; Quan, personal communication). Most of this planting has occurred along the North Fork Toutle and Green Rivers, and along Hoffstadt, Elk, and Schultz Creeks. Cottonwood, alder and willow were the species most commonly planted.

In addition to the above plantings of woody vegetation, a grass seeding program was also accomplished. The Weyerhaeuser Company seeded approximately 10-13 miles of riparian zone in 1980. The bulk of seeding, however, was done by the Soil Conservation Service (SCS), U.S. Department of Agriculture.

SCS aerially applied grass-legume seed and fertilizer to areas within the blast zone in the fall of 1980 (Stevens et al., in press).

Although artificial revegetation is occurring in many areas throughout the watershed, it will not be permitted within the Mount St. Helens National Volcanic Monument boundaries. The 110,000-acre monument was created to protect the significant geologic, ecologic, and cultural features in the impact area for public education/interpretation, recreation and research. As a result, runoff and flood protection measures will require special approval in this zone.

In some areas near the blast zone, pre-blast vegetation still remains. For example, a small amount of old growth timber still remains along the Green River just west of Goat Mountain within Forest Service boundaries. Old growth forest provides habitat for a wide variety of vertebrates. As many as 52 bird and mammal species utilize this habitat (USFS, 1981).

Snag habitat was created on the edge of the blast zone by thermal effects. During salvage operations the Washington Department of Natural Resources and the U.S. Forest Service have left snags standing in small tracts along the Green River and Miners Creek. This habitat is utilized by as many as 83 species of birds and mammals.

New wetlands are beginning to develop in the basin. Conditions along the Toutle mainstem and North Fork indicate that two major wetland types could develop. These include: 1) a wide flat valley bottom type with multiple stream channels which are regularly inundated by flood waters; and 2) a flood plain type which receives tributary flow either as surface flow or groundwater (Meyer, personal communication). The Toutle River and North Fork of the Toutle River have aggraded with nearly every major storm in 1981 and 1982. This has led to channel configurations of the first type in many reaches.

Deposition in areas where a broad flood plain exists as a result of the May 1980 and March 1982 debris flows has created marshy conditions. Areas along the south bank of the Toutle at RM 4 and the north bank of the North Fork at RM 3 are examples. Tributary surface and groundwater flow, as well as precipitation, has probably been the source of water in these locations. If aggradation continues, flooding flows will also contribute to the water budget of these wetlands.

In mudflow areas along the river bottoms, dense 2- to 3-foot-high alder thickets are growing. Although Weyerhaeuser Company has planted cottonwood in some of these same areas, they have in many cases been crowded out by the alder (Meyer, personal communication).

During emergency actions following the eruption, sediment stabilization basins (LT-1 and LT-3) were used as sediment traps in the lower Toutle River. Habitats remaining in these areas are shown in Figures 10 and 11. Habitat descriptions are contained in Appendix B.

Wildlife

Elk are returning to the blast-affected area as vegetation recovers. In the fringe areas of the blast zone, landowners have had some difficulty re-establishing vegetation because of elk browsing (Kuttel, personal communication; Anderson, personal communication). Elk within the Mount St. Helens area have been observed in a wide range of vegetation types during

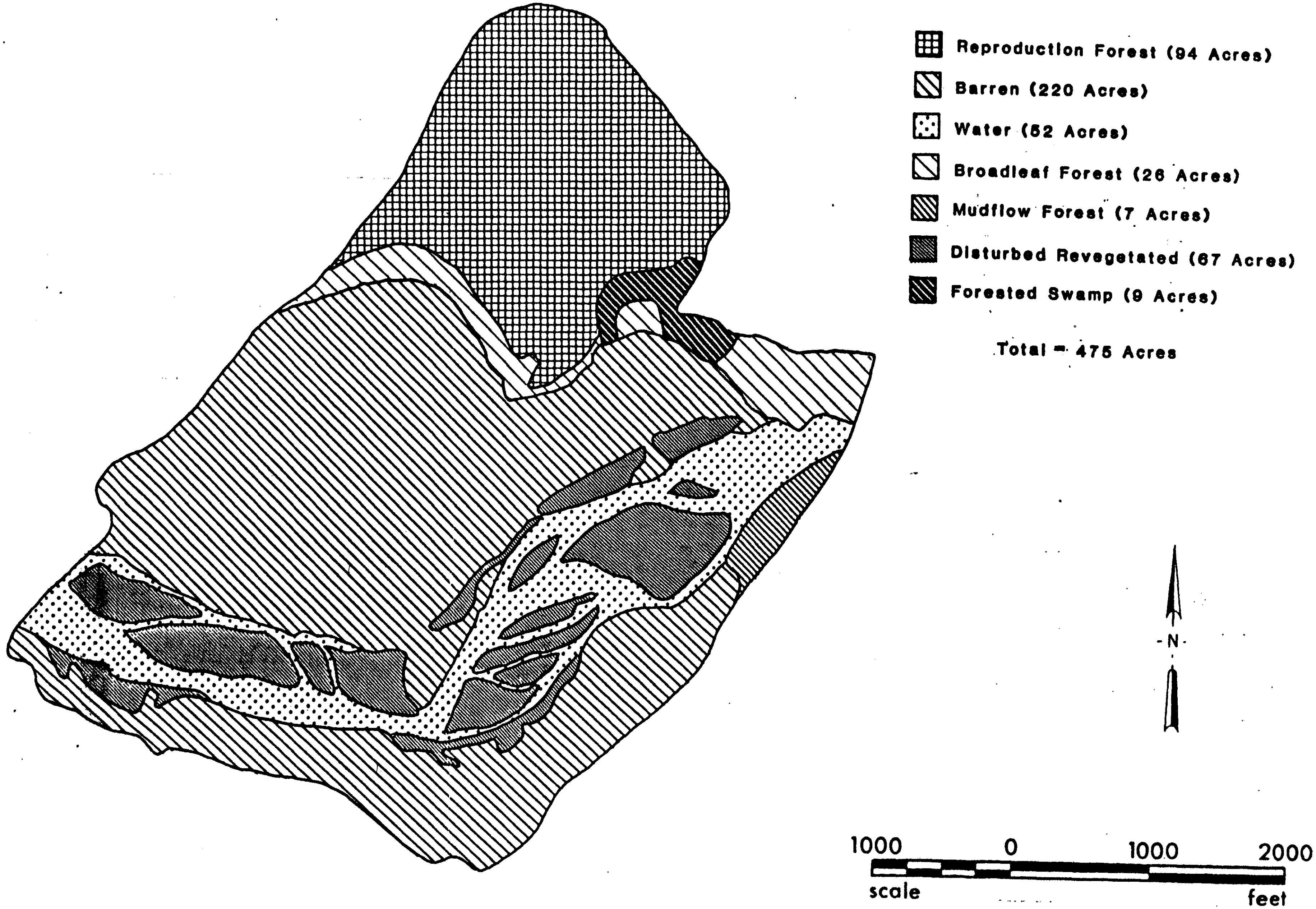


Figure 10. Post-eruption Habitat Types at LT-1.

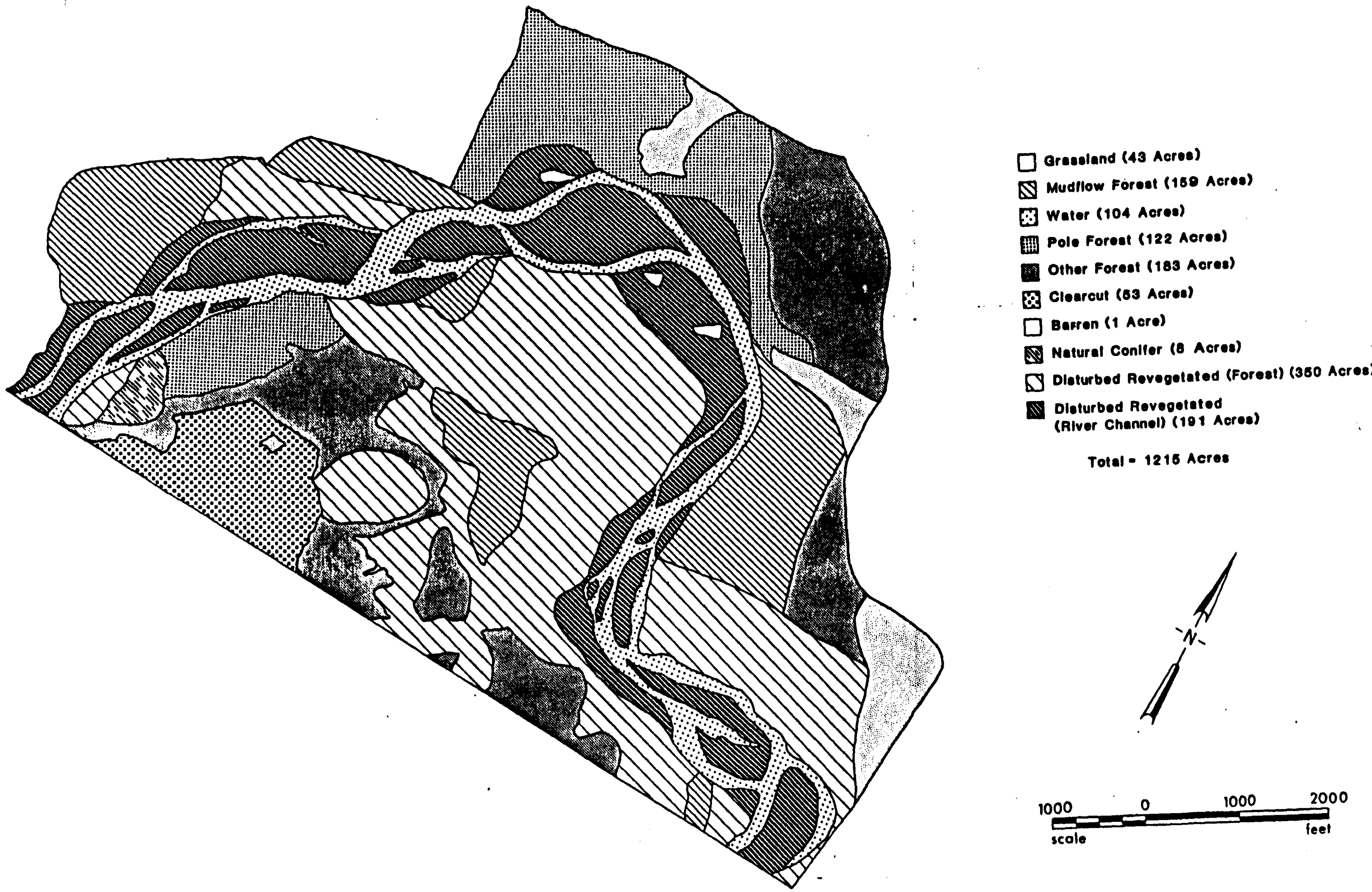


Figure 11. Post-eruption Habitat Types at LT-3.

late fall and early winter. Except for unsalvaged timber stands, no vegetation types were avoided (Merrill, 1982). Animals south of the Green River were sighted most frequently in salvage logged and scarified sites. These were common habitat types in this region. Remnant stands of old growth and second growth conifers are scarce within the blast zone. However, these areas are used consistently by elk during inclement weather and provide the best thermal and hiding cover available. Standing dead timber was used also for this purpose. In the absence of such stands, elk used topography and distance to escape humans. The majority of elk observed during studies by Raedeke et al. (1982) were associated with swales, ground seeps, or marshes. These areas tend to provide green herbaceous vegetation late in the season. Kuttel (personal communication) has indicated that riparian areas are of particular importance to elk during the winter. Elk also have been observed regularly on the seeded mudflow of the North Toutle River during November and December. A distribution of major elk groups is shown in Figure 12 and Table 10.

Generally, elk move up in elevation and spread out during calving season. Cows calve in the blast zone in the North Fork area, as well as in the Green River area (Merrill, personal communication). Figure 12 indicates known calving areas. Recently cow:calf ratios have been particularly high. Following the eruption the ratio was 100:32 inside the volcano closure zone (WDG, 1980). The 1981 season showed a 100:64 ratio, indicating twinning is occurring; a highly unusual situation for Roosevelt elk (Kuttel, personal communication; Thomas, 1983). With the exception of the restricted area (Red Zone) around the volcano, elk recovered sufficiently by 1982 to permit hunting again in the blast area (Stoddard, personal communication). Kuttel (personal communication) believes that the past two mild winters have reduced winter mortality for elk even though good wintering areas are scarce. However, winter forage is likely to be an important limiting factor in the near future (Anderson, personal communication).

Information on deer population changes and movement is less extensive than for elk. No deer carcasses were observed in the spring of 1980 on regular carcass census routes. Records for 1980 indicate that adult:fawn ratios were lower than normal (100:37). This decline may have been the result of a previous severe winter (1979) and the eruption. Deer populations from 1979 to 1982 were down approximately 74 percent along the North Fork of the Toutle River, and up 8 percent along its South Fork (WDG, personal communication). Deer hunting has resumed.

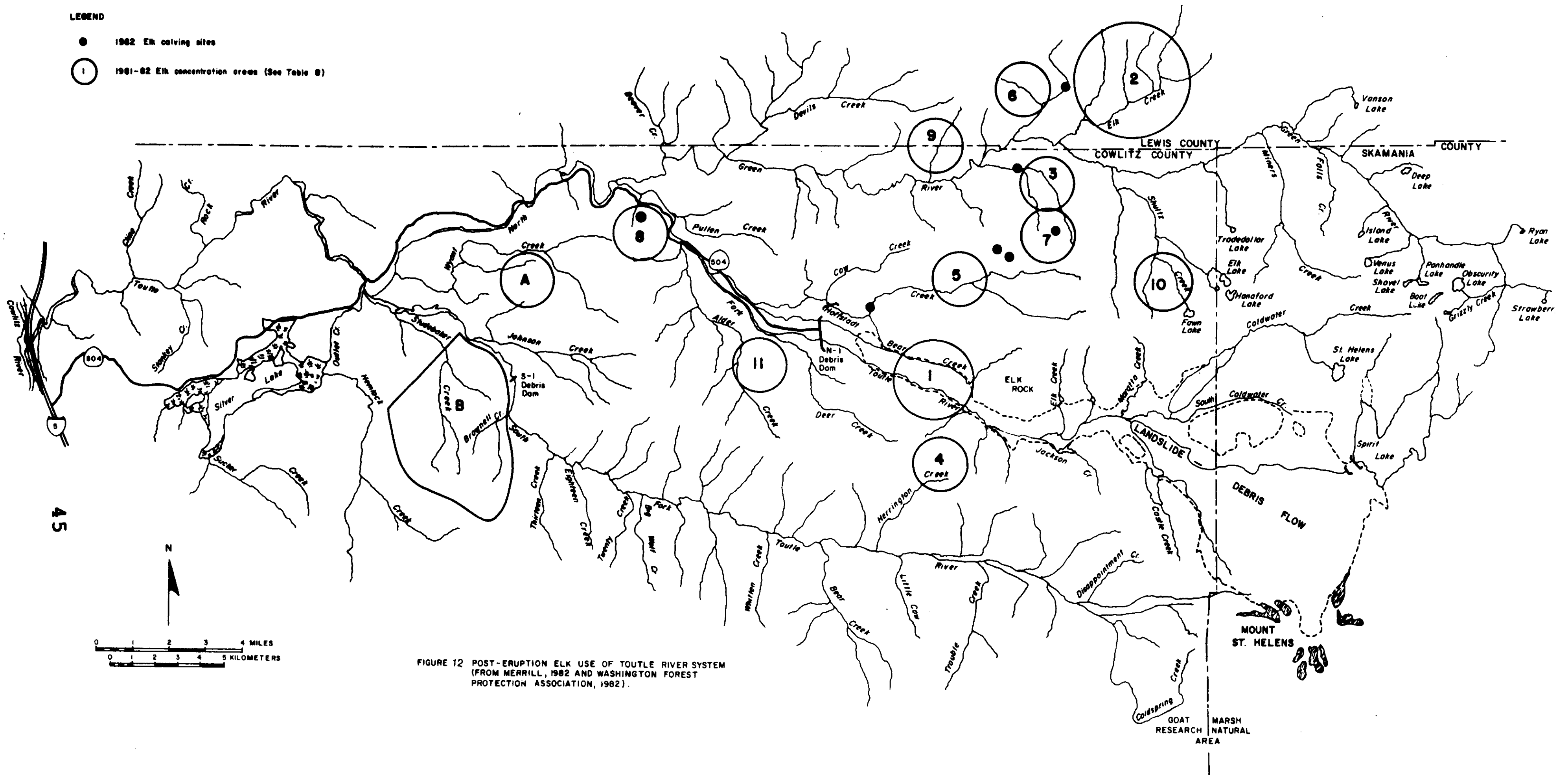


FIGURE 12 POST-ERUPTION ELK USE OF TOUTLE RIVER SYSTEM (FROM MERRILL, 1982 AND WASHINGTON FOREST PROTECTION ASSOCIATION, 1982).

Table 10. A Summary of the Distribution and Estimation of Abundance of the Major Elk Groups on Mount St. Helens in the Study Area. Locations are shown in Figure 7.1/2/

Map Number	Location	Number of Elk
1.	Elk Creek (roads 2600, 2645)	90-100
2.	Hoffstadt Creek (roads 3100, 3200)	55-60
3.	Spotted Buck (roads 3000 and 3060)	60-70
4.	Roads 2570, 2574, 2575 and 2571	50-60
5.	Road 2700	40
6.	Mudflow - North Toutle	6
7.	Spirit Lake Highway	30-45
8.	Road 2501 above Camp Baker	10-15
9.	Roads 1110/1113	30-45
10.	Road 2520	0

A. Wyant Creek T10N R1E Sections 34 and 35.

B. T10N R1E Sections 2-5, 8-11

1/ From: Merrill, 1982.

2/ From: Washington Forest Protection Association, 1982

Cougar and black bear have been sighted on monthly censuses along the Green River by Weyerhaeuser Company personnel (Anderson, personal communication). Hunting seasons for these species also resumed in 1982.

With only a few exceptions, furbearer and other mammal species found in the area before the eruption have again been sighted (Anderson, personal communication). Twenty-six mammalian species have been observed along a wildlife census route traveled by Weyerhaeuser personnel. Rodent populations in

some areas seeded with grass following the eruption are particularly high. Microtus populations in some areas are 300 voles/acre compared with 5 to 10 voles/acre in undisturbed areas (Anderson, personal communication).

Several new lakes were created within the blast zone when mudflows blocked streams (i.e., Coldwater, South Coldwater, and Castle Creeks). These new lakes, in addition to existing lakes and streams, provide habitat for numerous species of waterfowl and aquatic birds. Canada geese, mallard, wigeon, sandhill crane, dipper, great blue heron, sandpiper and gulls have been observed in censuses conducted along and south of the Green River (Anderson, personal communication).

Ruffed and blue grouse have again been sighted along the Green River (Anderson, personal communication).

A variety of raptors including Cooper's, marsh, red-tailed, rough-legged and sharp-shinned hawks; northern harrier; American kestrel; merlin; and osprey are again using the Green River drainage (Anderson, personal communication). Golden and bald eagle have also been sighted. It is unknown whether spotted owls are continuing to use remaining old growth timber within the blast affected area.

Bird use in the blast affected area is continuing to increase and 107 species have been observed on Weyerhaeuser wildlife censuses. Species noted are comparable to those presently seen in the unaffected areas. Willow flycatcher, western bluebird, loggerhead, shrike, and yellow warbler have been sighted in the area (Anderson, personal communication). Snags which resulted from the blast are being used by a variety of bird species, including mountain bluebird, pileated woodpecker, downy and hairy woodpeckers, and a variety of other cavity nesters.

Future Without the Project

Recovery and revegetation within the blast area will vary according to pre-eruptive site conditions, the severity of the impact received, and man's activities (i.e., actions authorized by P.L. 98-63). Successional patterns can only be estimated by using current plant distributions in the area, past succession of other volcanically disturbed areas, and general information about forest succession. It is assumed for the purpose of this study that a major volcanic eruption will not recur in the near future (although in actuality smaller additional eruptions have occurred and are likely to

continue). The Forest Service (1981) has outlined a possible scenario for revegetation in blast and mudflow affected areas.

In areas with blowdown and standing dead timber and areas with considerable ashfall, residual species are contributing most heavily to early revegetation. Although above ground parts were killed, shoots from unharmed below-ground parts have quickly appeared. Fireweed is common in areas which were clearcut prior to the blast. This species will probably remain dominant for 4 to 5 years or longer. Although some seeds have sprouted in the blast area this past year, at other volcanic sites reproduction from seed did not become significant for as long as 35 years.

Following a forb-dominated period, a shrub domination will probably occur which could last from 10 to 25 years. Huckleberry and vine maple are expected to comprise a significant proportion of the vegetative cover. Riparian areas will probably contain devil's club and, depending on elevation, Sitka alder or red alder. In many areas dense alder thickets already occur. Erosion in some riparian areas could be severe.

Although conifers have invaded the blast area, they will probably not become conspicuous for 15 to 25 years. Conifer stands may develop in 40 to 50 years. Stable forests can be expected in 50 to 150 years.

In areas of mudflows and pyroclastic flows, revegetation will probably occur as small "islands" in areas which have protection from the elements. Vegetation will then radiate out from these sites. Fireweed and lupine will probably be the early pioneer species. Some areas may remain barren. At other volcanic sites some areas have remained barren for as long as 50 years.

A shrub-dominated stage could occur in 15 to 25 years; alders will probably be the early dominants. Under ideal conditions, lodgepole pine will begin to replace shrubs in 20 years and good stands may develop within 50 years. Douglas-fir and western hemlock will also move in relatively early, but will not be as important as lodgepole pine. Silver fir and subalpine fir could form stands, at higher elevations, within 50 years. Stable forests may develop within 200 years but could take considerably longer at some sites.

As revegetation occurs, wildlife populations are expected to gradually increase to pre-eruption levels. Elk are continuing

to use remaining wintering range along the North Fork and Green Rivers and will probably utilize these areas more as riparian vegetation recovers. Species such as spotted owl and goshawk, which are dependent on old growth habitat, will require longer time periods to recover. The mountain bluebird and pileated, three-toed and black-backed woodpeckers may increase in response to newly-created snag habitat located in blast fringe zones.

The future of wetland areas is uncertain. Even if undisturbed by man, riparian and wetland areas are not stable along the Toutle River. As lateral migration occurs in main channels reworking flood plain deposits, vegetated marsh could be again changed into a series of channels. Although the channel aggradation will continue in the near future, the amount of sediment supplied to the stream will eventually decrease causing channel incision throughout the river system. This should not significantly affect wetlands fed by tributary surface flow, but it could decrease flooding frequency and lower the local groundwater base level, thereby reducing wetland water supplies. These changes are likely to occur first in the North Fork of the Toutle valley, then in the main valley (Meyer, personal communication).

Future With the Project

No Action

The "No Action" alternative would result in work authorized by PL 98-63 being continued on the lower Toutle River. Impacts on wildlife resources would be as described under Without the Project.

No Action With Interim Measures (PL 98-63)

With this alternative, recovery of wildlife habitat in the upper portion of the basin would proceed through natural succession to conditions approximating pre-eruption habitat. However, habitat in the lower portion of the Toutle River Basin (as well as the Cowlitz and Columbia Rivers) would be adversely affected by work authorized in PL 98-63. Specifically, the CE would continue to maintain flood control measures along the Toutle and Cowlitz Rivers and maintain the Columbia River Navigation Channel. To provide the flood protection, increased dredging would be required in the river, and the LT-1 and LT-3 sites would be increased in size. This would result in an additional 5,000 to 6,000 acres adjacent to the lower Toutle River being covered with dredge material. As

a result, additional wildlife habitat not previously impacted by the eruption or emergency actions, would be adversely impacted. Additional wildlife habitat would also be lost along the Cowlitz and Columbia Rivers because of increased disposal needs generated by this alternative.

Multiple Retention Structures (MRS)

Construction of two or more retention structures would have a major impact on wildlife resources. Each structure would have similar impacts and substantially increase the total acreage of wildlife habitat covered by the deposition of sediment. This would occur on existing and developing wetlands and uplands along the entire length of the Toutle River. This alternative, by its spatial configuration, would impact wildlife habitat to a greater extent than all other alternatives.

Single Retention Structure (SRS) With Sediment Stabilization Basins

Impacts of this alternative would vary with the location of the structure (i.e. LT-3, Kid Valley, or Green River). The Green River site was most severely impacted by the eruption and its development would have the least impact on wildlife resources.

Placement of the SRS at the Green River site would result in approximately 3,600 acres being covered by sediment during the life of the project. Barren conditions similar to those behind the existing N-1 structure are expected. The SRS would reduce sediment input to downstream areas and hasten stabilization of the stream channel. This would allow riparian, wetland, and upland areas of high wildlife value to develop within the Toutle River flood plain. However, long-term effects may be detrimental because of the reduction in downstream movement of gravel, sand, etc. needed to maintain the sediment budget of the Toutle River.

Use of interim measures to control sediment input to the Columbia and Cowlitz Rivers, specifically sediment stabilization basins LT-1 and LT-3, would also adversely impact wildlife habitat. A total of 1,533 acres; 422 at LT-1 and 1,111 at LT-3, would be covered by dredge disposal. These areas would remain barren throughout the disposal period and as long as 10-25 years thereafter unless revegetation actions are implemented following disposal activities.

A detailed analysis of the Green River site was conducted to determine wildlife values, project impacts, and mitigation requirements. This was done by using the Habitat Evaluation Procedures (HEP) developed by the Fish and Wildlife Service. A description of procedures, methodologies, and findings is presented in Appendix B.

Construction of the Green River SRS is expected to result in a reduction of habitat available for Roosevelt elk, small predators (e.g. shorttail weasel, bobcat), small mammals (e.g. Townsend chipmunk) and amphibians (e.g. Pacific giant salamander). Other species are expected to show some increase in available habitat (e.g. common snipe, mallard, song sparrow, black-tailed deer, and beaver). Habitat for species such as red-tailed hawk, golden-crowned kinglet, and ruffed grouse is not expected to change significantly over the next 50 years.

Although not evaluated in the HEP analysis, stabilization of the Toutle River downstream from the retention structure would speed recovery of riparian vegetation. This is likely to result in improved wildlife habitat conditions during the life of the project.

THREATENED AND ENDANGERED SPECIES

In accordance with Section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531, et seq.), all federal agencies are required to assure that their actions have taken into consideration impacts to federally listed or proposed threatened or endangered species for all federally funded, constructed, permitted, or licensed projects within their jurisdiction.

Through coordination with our Endangered Species staff, we have determined that listed species may be present within the project area. You may consider the list provided in Appendix D as a response pursuant to Section 7(c) and you may begin a biological assessment if you determine this action to be a "construction project."

If you have any questions regarding Endangered Species or your responsibilities under the Act, please contact:

Mr. Jim Bottorff
Endangered Species Team Leader
U. S. Fish and Wildlife Service
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COWLITZ RIVER

The Cowlitz River is the lowest major tributary to the Columbia River. It drains the west slopes of the Cascade Mountains, specifically the north and west sides of Mount St. Helens, the southeast side of Mt. Rainier, and the northwest portion of Mt. Adams. The drainage basin encompasses 2,480 square miles. Two hydroelectric dams control about half the basin and affect downstream flows. The Toutle River is the major tributary below the dams.

The Cowlitz River in the project area is a low gradient stream. It has a channel slope of 4.5 feet per mile above RM 14.5 and 1.2 feet per mile below RM 14.5. For the most part, it flows through a flood plain 1/2 to 1 mile wide. It is confined by hills to the east and west. Below RM 5, the flood plain extends to the west for 4 to 5 miles, encompassing all of the town of Longview.

The cities of Longview and Kelso and their industrial areas facing each other across the Cowlitz River are protected by levees, as is the city of Castle Rock. Lexington, an unincorporated area, is partially protected by levees. The rest of the flood plain area, from RM 10 to 16, and 17.5 to 27.5 is not protected. This is a rural area of pastureland, small farms, rural homes, and riparian forested areas. There were several commercial sand and gravel operations along the river before the eruption.

FISH

Pre-eruption

Significant numbers of fall chinook salmon spawned in the lower Cowlitz River between Kelso and the mouth of the Toutle River. An average of 183 (range 86 to 354) redds (spawning nests) were observed in this section of river during annual aerial surveys conducted by WDF personnel between 1973 and 1979 (Mohoric, personal communication). Fall chinook produced in this river reach contributed 7,320 fish worth $360,400 annually to sport and commercial fisheries.

The lower Cowlitz River was a migration pathway and rearing area for anadromous salmon and trout produced in the Toutle and upper Cowlitz River Systems. It also hosted a large spawning run of smelt (eulachon).

Juvenile or adult anadromous salmonids occurred in the lower Cowlitz River throughout the year. Downstream migrations of juvenile fish generally took place from late winter to early summer. Upstream migrations of adult fish peaked at different times of the year in the lower Cowlitz, depending on the species, race, or stock of fish. However, each run of fish lasted several months so that they overlapped and adult salmonids were present in the river at all times. Figure 5 shows the general times that salmonids were present in the lower Cowlitz River.

Concentrated sport fisheries for fall and spring chinook salmon occurred at the mouth of the Cowlitz River, at Riverside Park in Lexington (RM 8.5), and at the Cowlitz-Toutle River confluence. Angling for steelhead and searun cutthroat trout occurred throughout the lower Cowlitz River.

Smelt usually entered the Cowlitz River between January and March whenever suitable water temperatures (about 40° F) occurred. Spawning occurred from near Kelso to the mouth of the Toutle River. After fertilization, smelt eggs adhered to substrates that ranged between sand and pea gravel in size. Eggs hatched after 2 weeks of incubation and larval smelt drifted downstream to begin their seaward migration.

Important commercial and personal use smelt fisheries took place in the lower Cowlitz River. Most fish were caught by dipnetting from boats or riverbanks. Average commercial smelt harvest for 1976 to 1980 for the lower Columbia River was about 2 million pounds (Mohoric, personal communication). Investigations by the Washington Department of Fisheries for 1978 showed that the sport catch equalled the commercial harvest. Much of the commercial and most of the sport catch occurred in the Cowlitz River.

Eruption

The mudflows from the eruption impacted the Cowlitz River Valley from the mouth upstream to about RM 25 (about 5 miles above the mouth of the Toutle). An estimated 40 mcy of material were deposited in the Cowlitz River and the channel infilled from 5 to 15 feet. In addition, a layer of mud up to several feet thick was deposited over the entire flood plain. Tributaries entering the Cowlitz were blocked or partially filled. Several water intake structures were also filled or blocked (USACE, 1981). Fish in the river at the time were presumed killed, either from suffocation due to high turbidities or high water temperatures.

Post-eruption

Stream habitat in the lower Cowlitz River remains in a very unstable condition. The Toutle River continues to carry large amounts of sediment into the Cowlitz. The heavier sand and gravel is deposited in the Castle Rock area. This material must be dredged out to provide the 100-year flood protection required by PL 98-63.

Since 1982 the lower 10 miles of the Cowlitz has reached an equilibrium with an accumulation of only 1 mcy. The sediment movement is very dynamic with winter scour and summer infill. On an annual basis, most of the material entering the Cowlitz from the Toutle is now passed on into the Columbia River.

The Cowlitz is very unstable laterally. Bank erosion is creating serious problems in some areas, such as Horseshoe Bend. The river is tending to braid, and bars and islands have formed in many places.

The stream gradient above RM 14.5 has increased to 5.1 feet per mile. The slope below RM 14.5 has stabilized at the pre-eruption gradient of 1.2 feet per mile.

Lower Cowlitz River tributaries that were blocked by mudflows have been cleared of debris and mud by the Soil Conservation Service. About 6.5 miles of stream channels have been dredged to prevent flooding and improve fish passage (Shavlik in Martin, 1982). Banks along these streams were seeded with grass and planted with woody vegetation during 1981 and 1982.

Spawning runs of smelt returned to the Cowlitz River in 1981, 1982, 1983, and 1984. The commercial harvest of smelt reported for the Columbia River tributaries was about 1.4 million pounds for 1981, 1.6 million pounds for 1982, and 2.6 million pounds in 1983. Much of this harvest was taken from the Cowlitz River. 1984 was a poor year with about 350,000 pounds taken from the entire Columbia River System. The success of smelt spawning since the eruption is unknown because of high turbidities and changing riverbed conditions. Smelt return to spawn at age 3 or 4. Effects of high turbidities on spawning success should have appeared in 1984. The smelt return to the Cowlitz in 1984 was low, with no return to the Kalama, Lewis, and Sandy Rivers. The global weather phenomenon known as El Nino could also have had an effect on returning smelt.

Future Without the Project

Large amounts of sediment would enter the Cowlitz River from the Toutle. The Corps sediment study predicts total yields of sediment to the Cowlitz River of approximately 34 mcy in 1985 with sand size material at 17 mcy. By 2013 sand yield to the Columbia would have dropped to about 4 mcy per year and remain at that level for at least 25 years. A total of 78 mcy of sediment would accumulate in the Cowlitz River in the first 20 years. Coarse sands and gravels would continue to deposit above Horseshoe Bend until the inflow drops to 5 mcy per year (about 20 years). At that time the river would begin to scour. As bed levels in the channel rise, more sediment would be deposited in the flood plain. The river would become very unstable as the bed fills, and could develop new channels during high flows. Braiding and lateral instability would continue until the deposited material has been scoured out. This process would continue for over 30 years. The bed of the Cowlitz would then begin to stabilize vertically and horizontally.

Gravel areas below the Toutle would eventually support successful spawning for fall chinook salmon, but this would not occur for many years. Turbidities in the Cowlitz would remain high. The Cowlitz would act mainly as a migratory path for salmonids. It is not possible to predict at this time whether the high turbidities and unstable substrate would have an adverse effect on smelt spawning, although it is expected that they would. Dredging in the Castle Rock area is expected to continue as long as economical disposal sites are available.

Future With the Project

Construction of a retention structure on the Toutle would halt sediment flow from the debris avalanche almost immediately. The Corps sediment study predicts that excess materials in the Toutle/Cowlitz system would erode out naturally in 3 years. Dredging in the Castle Rock area would continue while the structure was being built. Dredging could be discontinued as soon as the river was able to maintain 100-year flood protection by itself.

Gravels immediately below the mouth of the Toutle should support some limited spawning by fall chinook within 5 years after the dam is completed provided that sufficient gravels remain or are augmented as necessary. Turbidities would be reduced, but would not return to pre-eruption levels since the dam is not designed to retain finer sediments.

Stabilization of the river bed would allow riparian vegetation to reestablish. This would provide water quality benefits in the form of reduced turbidity and temperature moderation, as well as a food source for fish and benthic organisms. Shallow water rearing areas for juvenile salmonids would also reestablish. Sport fishery opportunities would increase with improved river conditions.

WILDLIFE

Pre-eruption

Habitat

Terrestrial habitat in the Cowlitz River valley was a mixture of pasturage/agricultural and riparian/flood plain. Habitat types were similar to those on the Columbia River. Additional tree species were present in the Cowlitz Valley, including big leaf maple, red alder, and coniferous species such as Douglas-fir, western hemlock, and western red cedar. These species were usually found at slightly higher elevations, out of the wetlands. Willow species may have differed from those along the Columbia River. Forested habitats were much smaller in size than on the Columbia, and there was more open space.

Wildlife

Human presence and related urban/industrial development limited wildlife species in the Cowlitz valley. Small numbers of black-tailed deer were present and black bear occasionally wandered down from the surrounding hills. Aquatic furbearers, although present, were of minor importance. Species present included beaver, muskrat, mink, nutria, weasel, and river otter. Small mammals, including rodents, were plentiful. Included were coyote, raccoon, opossum, striped skunk, eastern cottontail rabbit, shrews, mice, voles, and moles.

The Cowlitz River valley had little waterfowl value. Small numbers of Canada geese, mallard, and wood duck may have nested in appropriate habitats. Use was higher during spring and fall migration and overwintering, but low compared to other sections of the Columbia River.

Ring-necked pheasant, California quail, ruffed grouse, band-tailed pigeon, and mourning dove were present in small numbers and offered limited hunting opportunities.

Raptors were numerous because of the excellent food supply (small rodents). Most common species were the red-tailed hawk, northern harrier, and American kestrel. Several species of owls were also present, and osprey were occasionally seen at the mouth of the Toutle. Numerous other bird species were also present. The most common included great blue heron, gulls, northern flicker, swallows, American crow, black-capped chickadee, Bewick's wren, American robin, European starling, song sparrow, blackbirds, and American goldfinch.

Eruption

Extensive areas of the Cowlitz River valley flood plain were covered by the mud flow. While most trees remained standing, the understory shrubs, forbs, grasses, and lower limbs of trees along the river bank were washed or abraded away. Back channels, sloughs, low spots, and small drainages were filled in and 1 to several feet of mud, ash, and debris were deposited on most of the unprotected valley floor. Forbs and grasses in the pasture and agricultural areas were also buried. Larger mammals may have been able to escape, although some cattle did not. Smaller mammals, especially underground burrowers, probably suffered almost total extinction, either from burying, suffocation, or heat. Birds probably had little direct loss because of the eruption, except for ground and shrub nesting birds whose nests were destroyed.

Post-eruption

Much of the vegetation covered by the mud flow was either killed outright at the time of the flow or died later. Willows and cottonwood, which are normally exposed to siltation annually, had a higher chance of survival than more upland species such as maple, alder, and conifers. It was also thought that the thinner barked trees (maple and alder) and young willow, cottonwood and conifers could have been killed or stressed by the high temperatures associated with the mud flow.

Shrubs associated with willows and cottonwood may have survived mud flow deposition, but many were abraded or washed away. Grass and forb survival varied with the amount of deposition.

Actual recovery from initial burying by the mud flow is mostly speculative, as much of the flood plain impacted by the mud flow was later used for dredge spoil disposal.

Work was started almost immediately to restore flood control capacity to the Cowlitz River channel. When work was phased out in the spring and summer of 1981, a total of 20 mcy had been removed from the lower Cowlitz (RM 0 to 9) and 56 mcy from the upper Cowlitz (RM 9 to 27.5). This provided a channel capable of handling 50,000 cfs. Approximately 7 miles of levees were built or improved to provide 500-year flood protection.

Dredging occurred again the winter of 1983-84 to restore 100-year flood protection; 7.8 mcy was removed from RM 13.25 to 20. The material was placed on existing disposal areas.

Disposal sites for dredged material are shown on Figure 13. Almost all of these sites have been filled; therefore, future dredge disposal capacity is extremely limited.

The State of Washington (Department of Transportation) has acquired some of the disposal areas in the vicinity of Castle Rock. These lands will be transferred to the Department of Natural Resources for management. Some of the dredging contractors have also bought parcels of land to be used for disposal. However, after the 1983-1984 winter dredging season, economically acceptable disposal sites have become even more limited.

There has been little or no recovery of wildlife habitat. Wooded areas were cleared before being used for disposal. There are a few remaining clumps of trees around farms and houses and the few places not used for disposal. The disposal sites have been seeded with grasses and legumes, but require continuous application of fertilizers containing nitrogen to survive. This has not been done.

Few mammals are now present in the area. Species remaining are those which can adapt to human activities, as most of the cover and food are around human habitations. It is not expected that shrews, moles, voles, and mice are able to survive in areas of deep deposition or spoil areas. Loss of these animals also means decreases in predator species such as coyotes and raptors. Birds inhabiting the surrounding hills may still find some food in the valley, but nesting sites and cover are extremely limited for many species.

Future Without the Project

The 100-year flood protection would be maintained under authorization of PL 98-63. Dredging in the Castle Rock area,

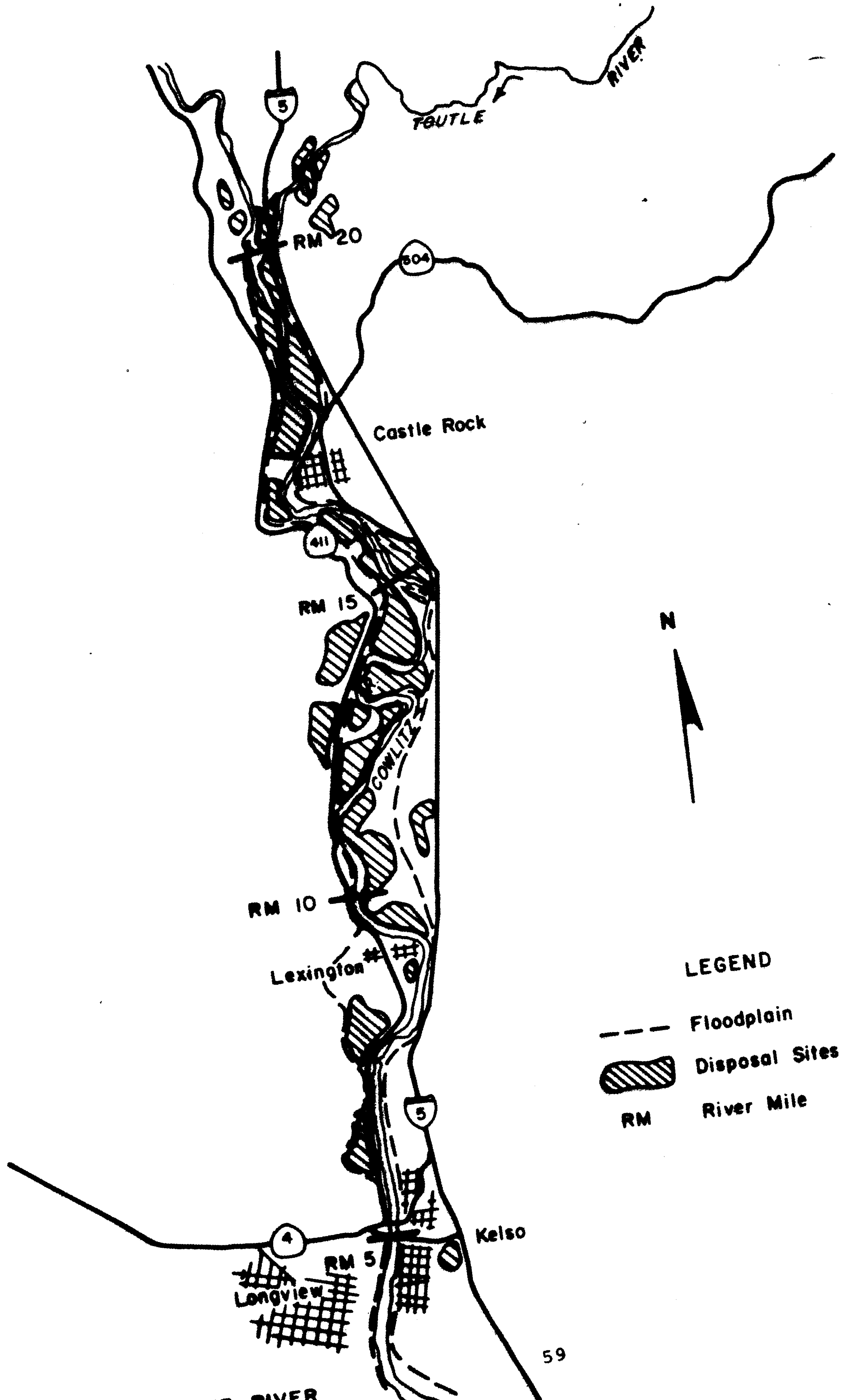

FIGURE 13 COWLITZ RIVER

as well as in the Toutle, would continue until economically feasible disposal sites are exhausted. After that the levees would have to be raised again. This would be a major project, as the entire levee system would have to be rebuilt with a wider base.

A very large storm or eruptive event, or 2 large storms back to back, could fill the channel in the vicinity of Castle Rock and Lexington and overtop the levees. Wildlife habitat in more urban areas, which had not previously been affected, would be impacted by flooding.

The river would remain extremely unstable, both laterally and vertically, for over 50 years. The river would probably break through at Horseshoe Bend (RM 13-15). Recovery of riparian habitat along the river would be slow and would not occur until the riverbed had stabilized. Disposal sites, once they had been filled to capacity, would gradually revegetate. Initial plant species would probably be lupine, grasses and scotch broom. Cottonwood and alder could be expected to become established within 10 years.

Future With the Project

Dredging under PL 98-63 would continue until the Cowlitz can maintain 100-year flood protection with natural flushing. This should occur about 5 years after the start of the project. Disposal sites in the vicinity of Castle Rock can be seeded to establish permanent revegetation at that time. The bed of the Cowlitz River should begin to stabilize about the same time, starting at the upper end. Emergent vegetation should also start to reestablish in the more stable areas. Riparian vegetation, such as cottonwood, willow, and alder, would also start to reestablish.

Small rodent populations should be noticeable on disposal sites 10 years after the start of the project. Raptor use would increase accordingly. Big game species would not return to pre-eruption densities until cover species had attained sufficient growth. This would probably be near the end of the project life. The numbers of avian species present which require this habitat type would also remain low.

THREATENED AND ENDANGERED SPECIES

Bald eagles may be sighted infrequently. There are no known endangered or threatened plants or candidate species in the Cowlitz River valley.

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COLUMBIA RIVER

The Columbia River is the second largest river in the United States. Its flows are regulated extensively by dams upstream on the mainstem and on tributaries. Average annual flows range between 150,000 cfs and 600,000 cfs. Flows in the Columbia west of the Cascades are directly affected by annual precipitation, particularly winter storm events. The lower Columbia is also subject to diurnal tidal effects. The drainage area above Longview is 256,700 square miles.

The climate in the project area is maritime, characterized by mild, wet winters and cool, dry summers. Average annual precipitation at Longview is 45 inches. Upper soils are of recent alluvium in origin, overlying older alluvium and glacial deposits which, in turn, overlie Columbia River basalt and other formations.

A detailed discussion of fish and wildlife in the Columbia River Estuary is contained in a recent Coordination Act Report on navigation channel deepening at the mouth of the Columbia River (Ellifrit, 1983). That portion of the Columbia River between RM 56 and 73 is discussed in more detail in the present report. This section of the Columbia River lies in the Lower Columbia subregion of the Puget Sound Trough. The Cowlitz River enters the Columbia where it bends to the west at RM 68 (Figure 1). Major islands remaining in this section of the river are Cottonwood, Howard, Lord, Walker, and Fisher. Cottonwood and Howard Islands and Lord and Walker Islands have been connected by deposition of navigation channel maintenance dredging material, and Fisher Island is now contiguous with the smaller Hump Island. Shorelines are relatively undeveloped. The city of Longview, Washington has an extensive industrial waterfront while Rainier, Oregon, across the river, is smaller and less developed. The remaining riverfront is low intensity agriculture (mostly grazing), either diked or undiked, or is in open space or is forested wetlands or dredge spoil. Trojan nuclear plant, on the Oregon shore, is at the upstream end of the project area.

FISH

Pre-eruption

The Columbia River and its tributaries support highly valuable runs of anadromous fish, as well as resident fish. In the project area, the Columbia serves as a migratory path for

adult and juvenile coho, chum, sockeye, and spring, summer, and fall chinook salmon; winter and summer steelhead trout; searun cutthroat trout; and shad (Figure 5). These fish are very important to both the commercial and sport fishery. Adult salmon and steelhead are normally found in deeper waters. Shallow waters such as side channels, sloughs, and backwaters are particularly important for food and cover for some juvenile salmonid species. Carrolls Channel is an important migratory path for juveniles.

Adult and juvenile sturgeon are also present in the area. Adults are more often found in deeper areas such as off Trojan Nuclear Plant. Juveniles tend to feed in shallow water.

Warmwater fish spawn, rear, and feed in backwater areas, although some are found in the main river. Game species include: yellow perch, black and white crappie, bluegill, warmouth, largemouth bass, brown and yellow bullheads, and channel catfish. Nongame species include: three-spined stickleback, carp, peamouth, northern squawfish, sand roller, chiselmouth, prickly sculpin, and coarse-scale sucker (Fies, 1971). Juvenile starry flounder, a marine fish, are also present in the Columbia in the project area.

The area has a fairly intensive sport fishery. Table 11 shows trips and catch for anadromous fish for 1979-1982. Important bank fisheries in the Longview/Rainier area are Prescott Beach, several shoreline areas upstream from Rainier, downstream from the Lewis and Clark Bridge on the Oregon shore, and Willow Grove Beach. Heavily used boat fishing areas for salmon are off Prescott Beach above Rainier, the mouth of the Cowlitz, below the bridge, the channel south of Lord Island, and the Washington shore along and below Willow Grove Island.

Commercial salmon gill net drifts are located in Carrolls Channel, off Cottonwood Island, above and below the Lewis and Clark Bridge, in the channel on the south side of Lord and Walker Islands, and on both sides of the main channel along Fisher Island and Willow Grove Island. An important sturgeon fishing hole is near Coffin Rock.

Angling pressure on warmwater gamefish is light to moderate. The more popular spots include Prescott Slough, Dibblee Point, Rinearson Slough, and Coal Creek Slough.

Table 11. Sport Fishery, Columbia River, River Mile 46-72. (From King, 1980, 1981, and 1982)

	1979	1980	1981	1982
Oregon Bank				
Salmon Trips	14,754	12,196	15,123	20,728
Catch				
Spring Chinook	118	299	503	1,583
Fall Chinook	751	179	239	384
Coho	46	26	0	267
Steelhead	256	588	133	2,249
Cutthroat	273	310	150	786
Sturgeon Trips	885	766	524	822
Catch	0	56	0	30
Shad Trips	3	0	0	0
Catch	0	0	0	0
Oregon Boat				
Salmon Trips	1,585	619	2,025	1,375
Catch				
Spring Chinook	12	16	167	113
Fall Chinook	67	0	6	1
Coho	29	0	0	1
Steelhead	0	0	0	0
Cutthroat	0	12	78	107
Sturgeon Trips	298	824	530	321
Catch	81	56	18	12
Washington Bank				
Salmon Trips	13,599	5,829	10,051	10,795
Catch				
Spring Chinook	58	64	49	
Fall Chinook	58	12	83	
Coho	1,069	187	271	67
Steelhead	711		732	865
Cutthroat	1,725	1,730	3,897	2,473
Sturgeon Trips	4,651	4,283	5,297	5,713
Catch	311	420	1,039	573
Washington Boat				
Salmon Trips	4,229	436	1,198	1,856
Catch				
Spring Chinook	5	6	0	0
Fall Chinook	244	0	26	17
Coho	981	0	0	408
Steelhead	0	0	0	0
Cutthroat	154	14	616	554
Sturgeon Trips	2,369	1,459	2,837	2,959
Catch	953	273	211	464

Eruption

The first mud and water flow from the eruption reached the Columbia on the afternoon of May 18. This flow was hot, and carried a high sediment load and tons of debris (both uprooted trees and cut timber from log decks). A second mud and water flow, two to three times the discharge of the first flow, occurred the night of the 18th and early the 19th. Between midnight and 5:00 a.m. the 40-foot navigation channel had filled in to 14 feet. Approximately 50 mcy of sand size and larger material was deposited in the Columbia, 14 million of it in the navigation channel. Deposition occurred between RM 63 and 72. Although there was an ebb tide at the time, almost all of the material was deposited upriver from RM 67.5 with a fairly uniform 15' depth across the Columbia at the mouth of the Cowlitz (USACE, 1981). The sturgeon hole at Coffin Rock was filled in, and an unknown quantity of material was also deposited in Carrolls Channel.

Additionally, millions of cubic yards of finer material was carried downstream in suspension with some being deposited in slower waters in the Columbia River estuary. Approximately 7 to 8 centimeters of fine sediment was deposited in some channel areas in Cathlamet Bay (Holton, personal communication). Although much of the trees, logs, and debris was carried to the ocean, some was stranded on the shoreline along with quantities of pumice and even heavier rocks.

Post-eruption

Dredging to reopen the navigation channel started immediately. The Corps of Engineers entire west coast hopper dredge fleet (three vessels) was at work within 3 days. The material was deposited adjacent to the channel and much was later rehandled by pipeline dredges.

Two inwater fill sites were created downstream. The Rainier fill, on the Oregon shore, had a capacity of 6 mcy. In addition to acting as an immediate disposal site, it fulfilled a long-standing Corps of Engineers desire to narrow the river at this point to make the channel self scouring.

Weyerhaeuser Company, on the Washington shore below the bridge, had been developing a plan to fill its entire waterfront and log storage area, but had not started the permit or Environmental Impact Statement process. A portion of this area was diked and 1.5 mcy of material placed in it by the Corps. Weyerhaeuser has continued to use this site to

dispose of material dredged to maintain adequate water depths along its waterfront.

The Corps has removed 2 to 5 mcy by overdredging the channel to 45 to 50 feet in the Longview area. This has provided some leeway in case of a storm event. Approximately 3 mcy has been dredged from the sump at the mouth of the Cowlitz in each of the past 3 years.

Temperatures and turbidities in the Columbia River dropped fairly rapidly, due to the dilution effect. A turbidity measurement at RM 47 on May 20th was 2,880 JTU's and had dropped to 27 JTU's by June 6. Background turbidity is normally 5 to 10 JTU's at this time of year.

The only adult anadromous fish in the Columbia River at the time of the eruption were spring chinook and shad. The eruption, as manifested by high turbidities and debris, did not appear to affect the migration of fish going above the Cowlitz. No effect was noticed on adult fish passage over Bonneville Dam. There was, however, a noticeable effect on downstream migrants. Although the peak of the out-migration had passed, there was a significant drop in juveniles captured at a permanent sampling site at RM 47 (Jones Beach). This was particularly true with fall chinook. Catches remained low for about 2 weeks while turbidities were still quite high. Catches later returned to normal (NMFS, 1980).

There were no known fish kills in the Columbia River due to suffocation, gill abrasion, or heat.

Researchers noted a number of effects in the Columbia River Estuary. The fine material which settled in the estuary affected benthic invertebrates and demersal fish.

Benthic sampling in some areas of the estuary revealed low numbers of *Corophium salmonis*, a brackish/freshwater amphipod, following the eruption. In other locations this species was present in normal numbers, but was buried under ash layers. It is assumed that this amphipod was adversely affected by the high turbidities, but the exact mechanism is not known. Almost no *C. salmonis* was found in stomachs of salmonid and non-salmonid fish collected in June 1980, and apparently no other food item was found to make up this loss. Comparison sampling a year later revealed that *C. salmonis* numbers had recovered or even increased in numbers over pre-eruption figures in benthic sampling. Starry flounder, a demersal fish, was feeding on *C. salmonis* at pre-eruption rates.

Juvenile salmonids, however, were not. The reason for this is not known (Emmett, 1982).

High turbidities due to resuspension of the fine material continued in the estuary for several weeks. Demersal species such as Dungeness crab and flounder were caught in a purse seine, which is used to catch pelagic species. Sight feeding fish were probably most affected, due to the low visibility, but recovered as soon as turbidities dropped. Demersal fish disappeared immediately after the eruption, but later returned in normal numbers (Durkin, 1982).

Sturgeon also were affected by the eruption. Test fishing in June and July 1980, indicated low numbers of sturgeon in the Columbia below the Cowlitz River. Many Columbia River tagged sturgeon were recovered outside the system as far south as Yaquina Bay in Oregon, and to the north in Willapa Bay, Grays Harbor, Neah Bay, and inner Puget Sound. This indicates that resident fish were forced out of the river by high turbidities (Stockley, 1982). Test fishing subsequently has indicated a return to pre-eruption numbers of both adults and juveniles.

The Corps sediment study for the comprehensive plan predicted that large quantities of sand and fines would enter the Columbia, with concurrent dredging requirements. An estimated 9.5 mcy of sand and 16 mcy of fines were delivered to the Columbia from the Cowlitz in water year 1983. However, an increase in dredging or deposition in the Columbia does not seem to have materialized. Navigation channel dredging amounts downriver have not increased. A study of deposition in the river showed an initial deposition of bedload material occurring outside the navigation channel. This material has since disappeared (Hartman, 1984).

Apparently the interim dredging measures have reduced the sediment inflow from the Cowlitz. However, a probable 10-year storm event in December 1982 deposited 2.4 mcy of sand in the Columbia at the mouth of the Cowlitz. As a result, 1.5 mcy had to be dredged from the navigation channel to restore authorized depths. Additional events of this kind are likely to occur.

Industries along the Longview waterfront have experienced greatly increased deposition of fines. Estimated dredging requirements are 0.5 mcy annually.

There is no information available on the fate of fines in the estuary.

Future Without the Project

With no interim actions (PL 98-63 and Cowlitz sump), approximately 351 mcy of sand and 277 mcy of fines are predicted to enter the Columbia in the next 50 years. One fourth of the sand and almost half of the fines will enter in the next 10 years. The majority of the sand (70 percent) will enter from the Cowlitz during the winter (October to March). The Cowlitz flows are high during this period and carry a heavy sediment load because of winter rains. In comparison, the Columbia flows, which control deposition in the Columbia, are relatively low. The Columbia has a net deposition between June and February and net scour during the spring freshet, March to May. Under winter flow conditions, most of the material could be deposited at or near the mouth of the Cowlitz and could block the navigation channel. The spring freshet flows are capable of removing most of this material, but the time of removal is not satisfactory. The remaining 30 percent of sand materials from the Cowlitz could be carried by the Columbia and probably would not require dredging.

It is estimated that approximately 7 mcy will be deposited in the Columbia River in the Longview area in 1985. This will decrease to 2 mcy by 2006 and stay at that rate for at least the next 30 years. Table 12 shows sediment yields to the Columbia and amounts deposited in the Longview area. It is estimated that, with a high sediment load, 40 percent of the material would be deposited in the navigation channel. In the one documented storm event (December 1982), 60 percent of the material was deposited in the channel. Using the conservative figure of 60 percent, dredge amounts were calculated as shown in the table.

It is presumed, however, that interim measures would continue under the no action alternative. With the interim measures, the base condition, 39 mcy would be dredged from the Toutle River and 74 million from the Cowlitz River. It is estimated that 521 mcy of sand and fines would enter the Columbia River. Of this amount, 71 mcy would be deposited in the vicinity of the mouth of the Cowlitz and would have to be dredged from the navigation channel; 450 mcy would move through the Columbia River system. This material would be 2/3 fines and 1/3 sand.

Operation of the Cowlitz sump would probably continue as long as economically feasible disposal sites were available.

Table 12. Sediment yield to the Columbia from the Cowlitz and amounts to be dredged in the Longview area in mcy (from Corps of Engineers data).

	Years							
	1985-89	90-94	95-99	2000-04	05-09	10-14	15-19	20-24
FINES	79	53	37	30	26	18	13	10
SAND	54	41	35	35	32	30	30	30
70% winter flow	37.8	28.7	24.5	24.5	22.4	21	21	21
Deposited Longview	32.5	24	17.5	11.5	10	10	10	10
Dredged (60%) Longview	19.5	14.4	10.5	6.9	6	6	6	6

Sump dredging may not have to continue for more than 15 years.

All of the above calculations are based on the 4 years of flow data collected since the eruption and do not include any major storm events. A 10-year storm event could deposit 3 mcy in the navigation channel. It has been estimated that a 100-year storm would require 5.1 mcy to be dredged from the channel and a large mudflow 6 mcy.

Normal maintenance dredging requirements of 1.1 mcy in this reach are also not included in Table 12. Apparently, no net deposition has occurred in the active channel outside the navigation channel. However, it is possible that seasonal deposition and scour is occurring. Some material would be deposited in back channels, with perhaps one half remaining permanently. When the material reaches the estuary, about RM 37, it may drop out in the shallow areas. Accelerated shoaling of the bays can be expected. A Corps study predicts a total of 202 mcy to be dredged from the estuary portion of the navigation channel (RM 2.0 to 33.7) over the next 30 years. Present dredging in the estuary is 2 mcy annually. It is expected that material dredged from Tongue Point (RM 18) and below will be disposed of in offshore sites.

Entrances to some sloughs and backwater areas along the river could be shoaled in to the extent that they are open only during high flows. These areas are used as feeding, resting, and cover by juvenile salmonids, particularly fall chinook, in their downstream migration, and by resident warmwater fish and juvenile sturgeon. All of these species enter such areas during the spring freshet and could become trapped as the water recedes.

During the past few years, over half of the regular maintenance dredging in the Columbia has been done by hopper dredge with inwater disposal. Continuation of this practice would accelerate shoaling of sloughs and backwaters to the detriment of aquatic resources.

The shallow parts of the estuary, such as Desdemona, Taylor and Upper Sands, and Grays, Cathlamet, Youngs and Baker Bays, would become even shallower. Deposition of both sand size and finer material from either river flow or inwater dredge disposal would have a definite adverse impact on benthic, epibenthic and vegetative production. Benthic populations would probably not be smothered outright, but production would be lowered and present species could be replaced by pioneer species. Shoaling of vegetated areas, as predicted by the Corps, would change the ratio of marsh types. Overall, high marsh would increase and estuarine primary productivity would be lowered, as high marsh contributes less to the system. This would in turn lower productivity of higher trophic levels. Species particularly affected would be juvenile salmonids and marine fish and crabs.

Offshore disposal of material dredged from the navigation channel is expected to have adverse effects on offshore benthic and fish populations. Existing sites would not be adequate for the additional material. At least one more offshore site would have to be located and designated to handle Mount St. Helens material.

Future With the Project

With any of the alternatives considered, sediment flow into the Columbia would be the same for the first 5 years. In year 1, 14 mcy would be removed from the Toutle at LT-1 and LT-3 and 13 mcy in year 2. This would reduce the yield to the Cowlitz to such an extent that the Cowlitz would begin to scour. An estimated 5 mcy would have to be dredged from the Columbia in year 1 and 4 mcy in year 2. The Cowlitz sump would be operated these 2 years, with approximately 3 mcy

removed each year. Based on past experience, no additional dredging should be required in the Columbia River navigation channel. The retention structure should be operational in year 3, cutting off all sand and larger grain size recruitment from the debris avalanche. Erosion of material from the Toutle and Cowlitz would yield a predicted 2 mcy a year for the next 3 years to be dredged from the Columbia River navigation channel. No additional dredging of sand size material is expected for the life of the project except for major storm events and/or mudflows before the project is built and after 1995.

Since the structures are not designed to trap fines, they would still be coming through the system. Turbidities would remain high and fines would be expected to deposit in side channels and backwaters in the river and shallow areas in the estuary. The total amount of fines would probably be somewhat less than predicted for the no action alternative as some material would be deposited in developing wetlands and shallow areas in the Toutle and Cowlitz.

WILDLIFE

Pre-eruption

Habitat

Terrestrial habitat along the Columbia River is characterized as riparian/riverine/bottomland/flood plain and ranges from tidal emergent marshes to open grassy or forested uplands. Riparian habitat types encompass wetland, transitional and upland water regimes.

Following is a discussion of the principal habitat types found in the area.

Riparian Forest (FO). There are 4 major habitat types in the riparian forest.

1. Mature willow. Usually Pacific willow. Can occur in very dense stands, at lower elevations. It is usually seasonally flooded by winter rains and spring freshets.

2. Ash swale. Usually pure stands of ash with little understory at higher elevation than mature willow. These sites may be flooded by spring freshets.

3. Ash/willow/cottonwood. This mixed species habitat has very high diversities and densities of bird and animal species.

4. Mature cottonwood. Usually found at slightly higher elevations than the above types. Pure stands of mature trees are often found on islands where heights may reach over 100 feet. This habitat is seldom flooded.

Common understory shrubs and forbs found in the forested habitats include: red-osier dogwood, red elderberry, snowberry, young willow and cottonwood, blackberries, salmonberry, climbing nightshade, stinging nettle, orange balsam, horsetail, cresses, candyflower, slough sedge, swordfern, and mosses.

Scrub/shrub (SS). This type is comprised mainly of Pacific willow, but Columbia River willow may be present, especially in low, sandy areas. Young cottonwood trees are sometimes present at upper levels.

Freshwater marshes (EM) are both tidal and non-tidal. Tidal marshes are usually in sheltered areas along the edges of the river, channels, sloughs, and backwater areas and are affected by daily tidal changes. Non-tidal wetlands are usually away from the river and may have standing water only during periods of high water or heavy rainfall. Species commonly found in these wetlands include: reed canarygrass, spike rushes, Juncus spp, bulrushes, sedges, skunk cabbage, common silverweed, mudwort, wapato, cattail, cyperus, docks, lilaeopsis, clovers, lowland cudweed, smartweeds, jointgrass, cocklebur, elodea, water plantain, and beggarticks.

Flats (FL) are areas of silty sand or finer materials which are normally exposed only during lower river levels. They are usually unvegetated because of the diurnal tidal changes, which are about 4 feet at Longview. The tides are most noticeable during the relatively low flow period from early August through October, but also have an effect on river levels at mid-range flows. Algae and benthic invertebrates found on flats provide an important food source for birds and fish.

A complex of habitat types has been designated grasses (GR). There are several types involved. One often occurs on dredge spoil areas along the river's edge. In addition to grasses, weed species such as tansy ragwort, thistle, teasel, and goldenrod are also found in this habitat. There is a

gradation depending on length of time since last spoiled upon. Sites which have not been used for 5 to 20 years will have some grasses, exotic weeds, and scotch broom. Sites which have not been used for over 20 years will have young trees and shrubs. These sites are usually upland.

Reed canarygrass is found over a wide range in elevation, but those sites which it dominates are usually at the upper edge of the wetlands, through the transition zone and into uplands. Stands in the open may be pure or contain other species such as sedges, common silverweed, and horsetails. It can also be the dominant understory plant in forested areas. Some seasonally flooded areas are reed canarygrass with scattered mature willow.

Grazed pasture land is usually composed mainly of grasses, with few weed species. It can be either upland, seasonally saturated, or flooded. Clumps of blackberry or wild rose are often present.

Major dredge spoil (DS) sites are Howard and Cottonwood Islands, Dibblee Point area, Hump Island, and Willow Grove. Sites may be bare land or sparsely vegetated, depending on when last used (0 to 5 years) and the amount of human disturbance. They have low to very low wildlife values, but are occasionally used as resting areas by geese and crows.

Wildlife

Black-tailed deer are the most common big game animals found along the Columbia. They are present on most of the islands and the non-industrialized portions on the Washington and Oregon mainland. Black bear are probably occasional visitors in the least developed portions, especially those with suitable habitat on the higher uplands. Table 13 shows the most common mammals by habitat type.

A number of aquatic furbearers are present in the wetter habitats, both on the islands and the mainland. Included are: beaver, muskrat, nutria, mink, weasel, and river otter. Nutria are the most numerous of the aquatic furbearers, while mink and river otter have the lowest densities.

Small mammals in the area include coyote, gray fox, bobcat, raccoon, opossum, striped skunk, eastern cottontail rabbit, and, on the Oregon side, brush rabbit. Seventeen species of small rodents have been recorded in these riparian habitats (Tabor, 1976). The vagrant shrew and deer mouse were present

Table 13. Occurrence of the Most Common Mammals along the Columbia River by Habitat Type (from Tabor, 1976).

Species	Habitat Type EM	RC	GR	SS	FO
Black-tailed deer		X	X	X	X
Beaver	X	X		X	X
Muskrat	X			X	X
Nutria	X		X	X	X
Mink	X				
River otter	X	X		X	
Coyote		X	X	X	X
Raccoon	X	X	X	X	X
Opossum		X	X	X	X
Striped skunk			X	X	X
Cottontail rabbit		X	X	X	X

in all habitats and had the highest densities. The vagrant shrew was more numerous in marsh and reed canarygrass habitat while the deer mouse had highest densities in forested areas. Townsend's vole was captured in all but marsh habitat. Cottonwood and willow/cottonwood habitat had the highest diversity of species.

The portion of the Columbia River between the estuary and RM 73 is of minor importance for waterfowl. Production, as in the rest of the lower Columbia River, is limited. Nesting species include the Canada goose, mallard, cinnamon teal and wood duck. Backwater areas such as Carrolls Channel, behind Dibblee Point, the area between Hump and Fisher Islands, and the Coal Creek Slough area provide suitable nesting and brooding sites. Migratory and wintering waterfowl are present

in greater numbers than resident birds, but much larger populations are found upstream and downstream on the Columbian White-Tailed Deer, Lewis and Clark and Ridgefield National Wildlife Refuges. There is a minor amount of hunting, mainly for mallard, pintail, wigeon, and Canada geese.

Upland game birds present adjacent to the Columbia River include ring-necked pheasant, California quail, ruffed grouse, band-tailed pigeon, mourning dove, and snipe. All are present in limited numbers and little hunting occurs. Ring-necked pheasants stocked on Cottonwood Island provide a private hunting opportunity.

A number of raptors use the Columbia for nesting, food, and cover. Common species include red-tailed hawk, northern harrier, American kestrel, western screech-owl, great horned owl, and saw-whet owl. Bald eagles are common in the estuary.

Riparian vegetation, especially the mixed deciduous tree types, provides a unique habitat for passerine birds. Some of the highest densities and diversities recorded in the literature are found in riparian forested habitat. During the winter black-capped chickadee, golden-crowned kinglet, song sparrow, and winter wren were found to be the most common species. Tree swallows and Swainson's thrush were most common in the spring and summer, respectively.

A large great blue heron rookery of approximately 200-300 nests is present on Fisher Island. There are smaller rookeries downriver at either end of Puget Island and a large rookery on Karlson Island in the Lewis and Clark NWR. A small rookery has recently been established on Price Island. The medium size rookery at Deer Island is the closest upriver site.

Several species of gulls are found on and along the river year round. Included are glaucous-winged, western, California, mew, herring, and Bonaparte's gulls. They are especially numerous during the winter eulachon run. Major gull nesting and loafing areas in the estuary are East Sand Island, Rice Island, and Miller Sands. A large number of caspian terns nested on East Sand Island in 1984. Other water birds present in the river, usually in the winter, are double-crested cormorant, common loon, and western and pied-billed grebes.

Bats are present in the area, depending on availability of roosting sites (i.e., abandoned buildings, bridges, and viaducts). Species probably present include little brown

myotis, big brown bat, and Yuma myotis. Roosting sites may be outside the project area, but riparian habitats provide foraging area.

Commonly occurring amphibians and reptiles include Northern red-legged frog, long-toed salamander, Northwestern salamander, Pacific tree frog, and garter snakes.

Eruption

Little or no flooding or deposition of material on wetland or upland areas occurred along the Columbia River during the initial mudflow. Any damage to wildlife habitat was caused mainly by the tremendous amount of logs, wood debris, and volcanic rocks carried down by the mudflow.

Post-eruption

The post-eruption effects on wildlife and habitat of the Columbia River have resulted from the extensive loss of habitat due to dredge disposal (Figures 14 and 15). A pipeline dredge started working the main navigation channel 2 days after the eruption. Three other large pipeline dredges were onsite early in June, dredging the Columbia and the mouth of the Cowlitz. Work in this area was almost continuous during the next 2 1/2 years with approximately 17 mcy removed. After the navigation channel was dredged to authorized depths and widths, additional dredging (8 mcy) was done to partially restore the normal cross section of the river.

Major deposition of material dredged from the channel has occurred in Washington between the Kalama and Cowlitz Rivers. There were approximately 1,700 acres of shallow water, wetland, and riparian habitat between RM 68 and 72 prior to the eruption (Table 14). Material dredged from the lower 1.5 miles of the Cowlitz was placed on the Collins Estate. All material removed by pipeline from above about RM 67.5 was placed on Cottonwood Island and on the proposed deepwater port site below the Kalama River. As shown in Table 14, about 740 acres of the 1,700 acre area have already been filled, and another 900 acres are designated as long-term disposal. Plate 5 depicts the Collins Estate pre- and post-eruption.

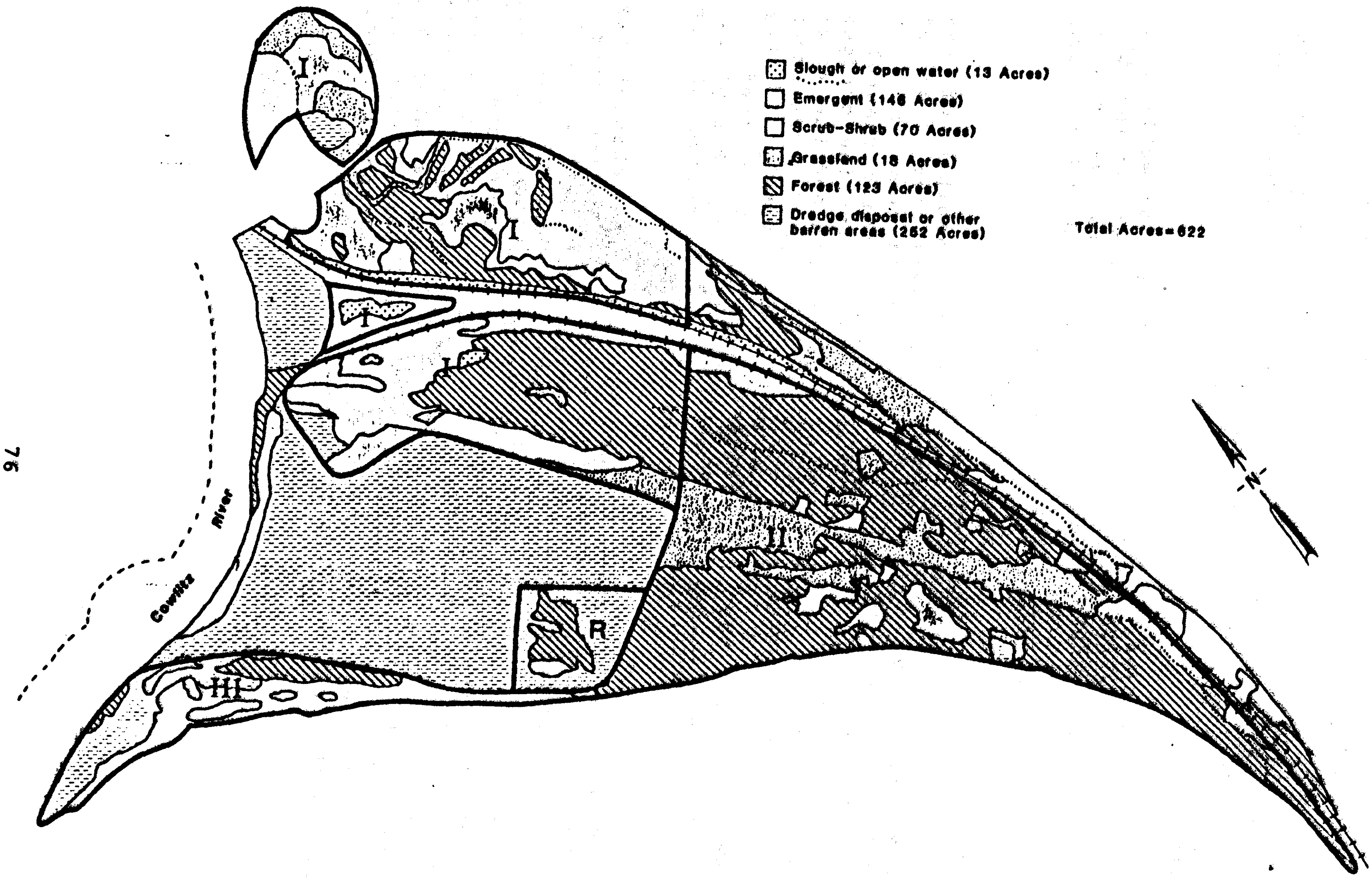

Figure 14. Post-eruption Habitat Types at the Collins Estate.

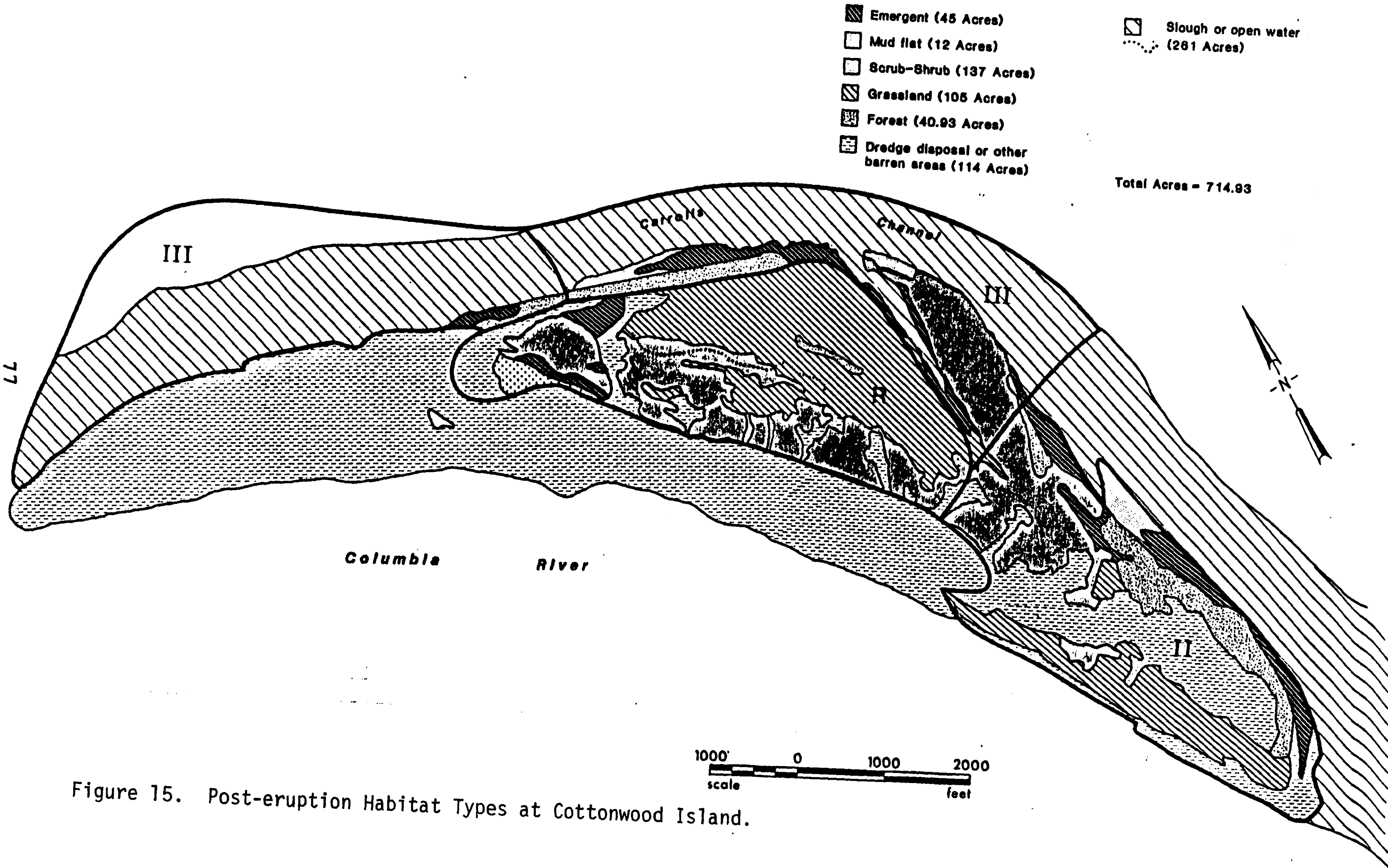

Figure 15. Post-eruption Habitat Types at Cottonwood Island.

Plate 5. The Collins Estate and adjacent area before the eruption (above) and after 2-1/2 years of spoil disposal (below). Note that scale differs.

Table 14. Dredge Material Disposal Sites between Columbia RM 68 and 72

Site No.[1]/	Location	Filled (Acres)	Proposed Fill (Acres)
1	Howard/Cottonwood Island	456	
2	Cottonwood Island		472
3	BN/Port of Kalama	65	110
5	Collins Estate	220	
6	Collins Estate		98
7	Collins Estate		328
Total		741	898

1/ Sites shown on Figure 16

Sumps have been periodically excavated every fall in the mouth of the Cowlitz River to trap and remove sediment before it reaches the Columbia. Approximately 3 mcy of material have been dredged annually from these sumps. This material has been placed on the Collins Estate (site 5) or Howard/ Cottonwood Island (Site 2).

All wildlife values have been lost on Howard Island. In early dredging phases, some clumps of trees were left. However, subsequent higher lifts have negated this action. Part of Cottonwood Island has been completely filled. In addition, the cove between Howard and Cottonwood Islands (on the Carrolls Channel side) has been diked and used as a settling pond, and is now almost completely filled. The Islands have been sold with industrial development being planned. Dredge material disposal and vegetation removal has destroyed much of the wildlife habitat on the Port of Kalama/BN site (site 3). The Port now wishes to fill the remainder of the industrial site which has been heavily impacted by initial land clearing and recent filling.

Wildlife values on the Collins Estate remain high. The higher quality wetlands are under the powerlines and to the north (site 6) and have had only minor impacts so far. A small great blue heron rookery has established in the last 2 years just southeast of the current disposal site.

During initial deposition on the Collins Estate, the Corps inadvertently filled an extensive wetland along Carrolls Channel near the mouth of the Cowlitz. In the fall of 1982 some of this material was removed to partially restore the wetland. A large area was lowered about 1 foot and a channel was dug from one end of the original wetland site to the other. A pond and cove were also excavated. Recovery of the site has been far faster than expected. By summer 1983 a number of emergent wetland plants were well established in the lower areas. Major species include wapato, softstem bulrush, several species of spike-rush and bur-reed. By summer 1984, wapato densities had increased and softstem bulrush had decreased. Some high marsh plant species are now appearing on the higher areas.

A small wooded area (site 16) is being used for disposal of material dredged from the channel in the old mouth of the Cowlitz. Wildlife values of this area have been lost.

Future Without the Project

Without the project, dredging and disposal sites will be required in the vicinity of the mouth of the Cowlitz for a number of years. The dredging load will be heaviest the next 10 years. Based on the events of the last 4 years, dredging will not be required below about RM 63. With no action, an estimated 26 mcy would have to be dredged from this area over the next 5 years. The 50-year dredging total at this site would be 145 mcy. This estimate does not include storm events.

Exhibit 5 to Appendix D of the Corps' Feasibility Study delineates proposed dredge disposal sites, including the lower 1 mile of the Cowlitz River and the Columbia River between RM 68 and 71. The Corps Navigation Branch prepared a disposal plan for this area several months ago. There are major differences in number, size, and capacity of sites in the two plans. The Feasibility Study plan also does not correspond in size or capacity with sites actually being used for the sump dredging the winter of 1984-1985. Because of these inconsistencies in Corps of Engineers planning, documents, and actions and the lack of environmental criteria in the selection of sites, we have developed and recommended modifications to these plans.

Both hopper and pipeline dredging would probably be required to maintain the navigation channel, particularly after storm events. Use of hopper dredges would allow a wider disposition of dredged material; for example, hoppers could unload in the vicinity of RM 63 to 64 and pipeline dredges could later place this material in sites 23 or 24.

It is expected that interim measures (PL 98-63 and Cowlitz sump) will be continued, at least for some time. Dredging in the Toutle and upper Cowlitz will reduce dredging requirements in the Columbia to an estimated 17 mcy over the next 5 years and 71 mcy over 50 years. Operation of the Cowlitz sump, removing approximately 3 mcy annually, should result in no appreciable amount of material needing to be dredged from the channel, except for storm events. This appears to be what has happened the past 4 years. There are adequate disposal areas at or near the mouth of the Cowlitz for almost all of this material.

It is possible, through some series of events, that material could be carried farther down the river before it was deposited. Depending on the amounts involved, wetland/ riparian/wildlife habitat along the Columbia River could be impacted. Upland disposal sites downstream are limited, i.e. much of the Washington shore is steep wooded hillsides where acceptable sites within easy range of a pipeline dredge are even more limited. Most areas bordering the river are either diked farm or pasture land or riparian/ wetland habitat. The few large areas where material could be placed with the least damage to wildlife habitat are some distance from usual shoaling areas.

The Service's HEP analysis was conducted on wetland/riparian habitat adjacent to the Columbia River from the Cowlitz to the upper end of Puget Island. The HEP analysis was based on habitat types and was not site specific. Based on the HEP, the following rankings, in order of highest value, were derived for habitat types: mature mixed forest; mature cottonwood; emergent marsh; shallow subtidal sloughs and backwaters; dredge spoil over 20 years old; diked pasture; intertidal unvegetated sand and mud flats; scrub/shrub; reed canarygrass; mature willow; mature willow/reed canarygrass; and dredge spoil 0 to 20 years old. The two highest ranked habitats are those probably most difficult to replace because of the time required for tree growth.

The species or guilds (a group of species utilizing a common resource) considered in the HEP were: aquatic furbearers,

juvenile salmonids, other fish (warmwater gamefish), passerines, food production (detritus, seeds, berries, insects), small rodents, raptors, waterfowl, deer, colonial nesting birds (mainly great blue herons), shorebirds (and marshbirds), and eagles.

The disposal sites identified by the Corps and the Service and shown in Figures 16, 17, and 18 were evaluated for suitability of use based on fish and wildlife values. The sites were classified in three categories; acceptable without mitigation, acceptable with mitigation, and unacceptable, as follows:

Acceptable without mitigation: sites 1 and 2 (except fringing marshes), 5, 10, 11, 12, 16, 20, 21, and 22.

Acceptable with mitigation: sites 3, 9, 13, 15, 18, 19, 23, and 24.

Not acceptable: sites 6 and 7.

Sites with significant wildlife resource values include part of 2, 6, 7, 9, 13, and part of 15. These areas vary in their value to wildlife. Resource Category determinations for these sites, based on Fish and Wildlife Service mitigation policies, range from Category 4 to Category 2. Mitigation goals would vary according to Resource Category, ranging from no net loss of in-kind habitat value (Category 2) to minimize loss of habitat value (Category 4).

The level of mitigation required would depend on the habitat type destroyed. High value habitat would require replacement in-kind in the vicinity of the disposal site. For lesser value habitats, options would include: habitat improvement of another area; securing through purchase, deeding or easement of another area; and revegetation of the disposal site.

Mitigation for individual sites should be determined by resource agencies, the Corps, project sponsors, and landowners before any site is used for dredged material disposal.

Future With the Project

The major impacts on wildlife would be loss of habitat due to dredge spoil disposal. The severity would depend on the amounts to be dredged and location in the system. The Feasibility Study predicts 15 mcy to be dredged from the Columbia under the preferred plan.

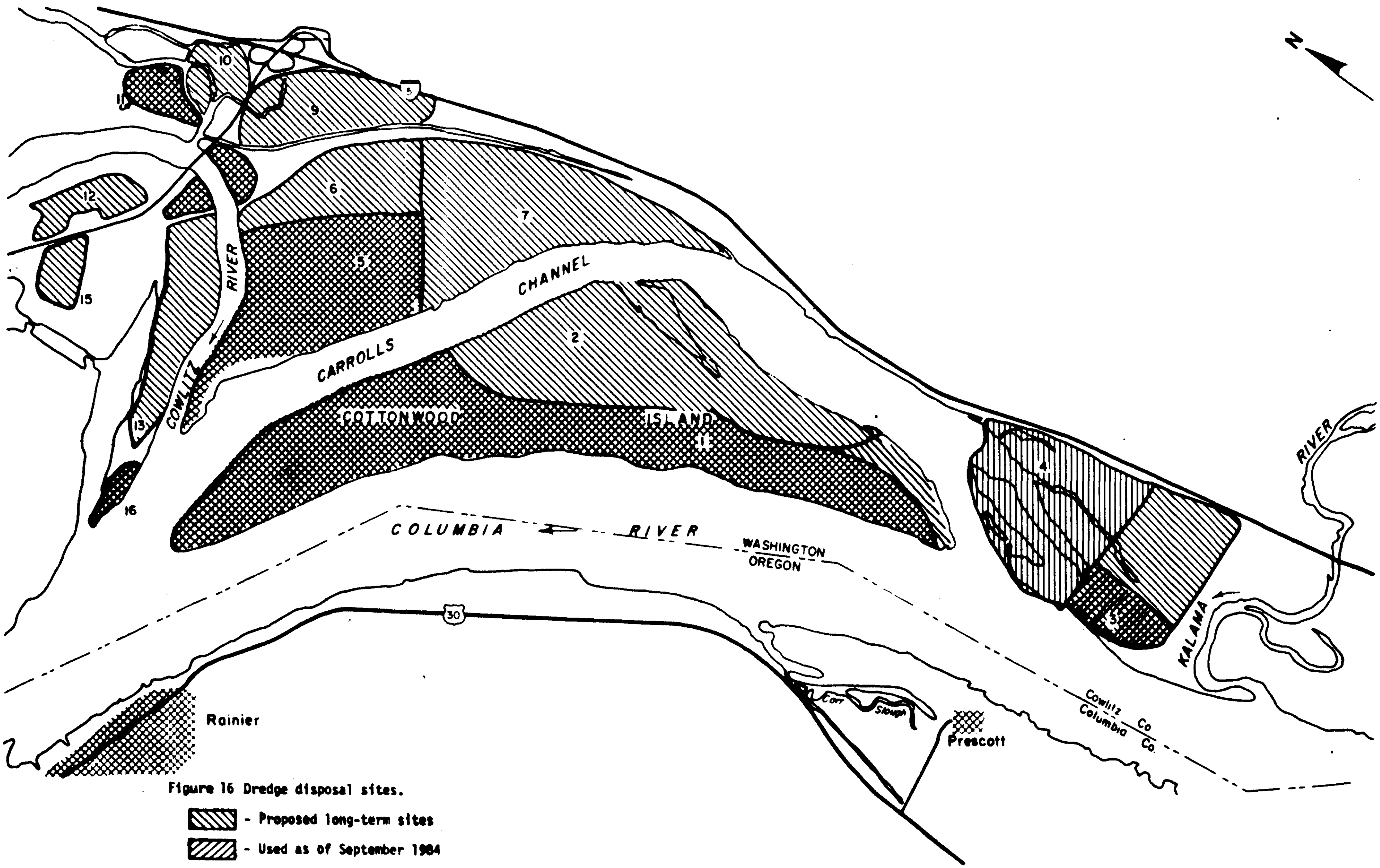

Figure 16 Dredge disposal sites.

- Proposed long-term sites
- Used as of September 1984
- Proposed mitigation sites

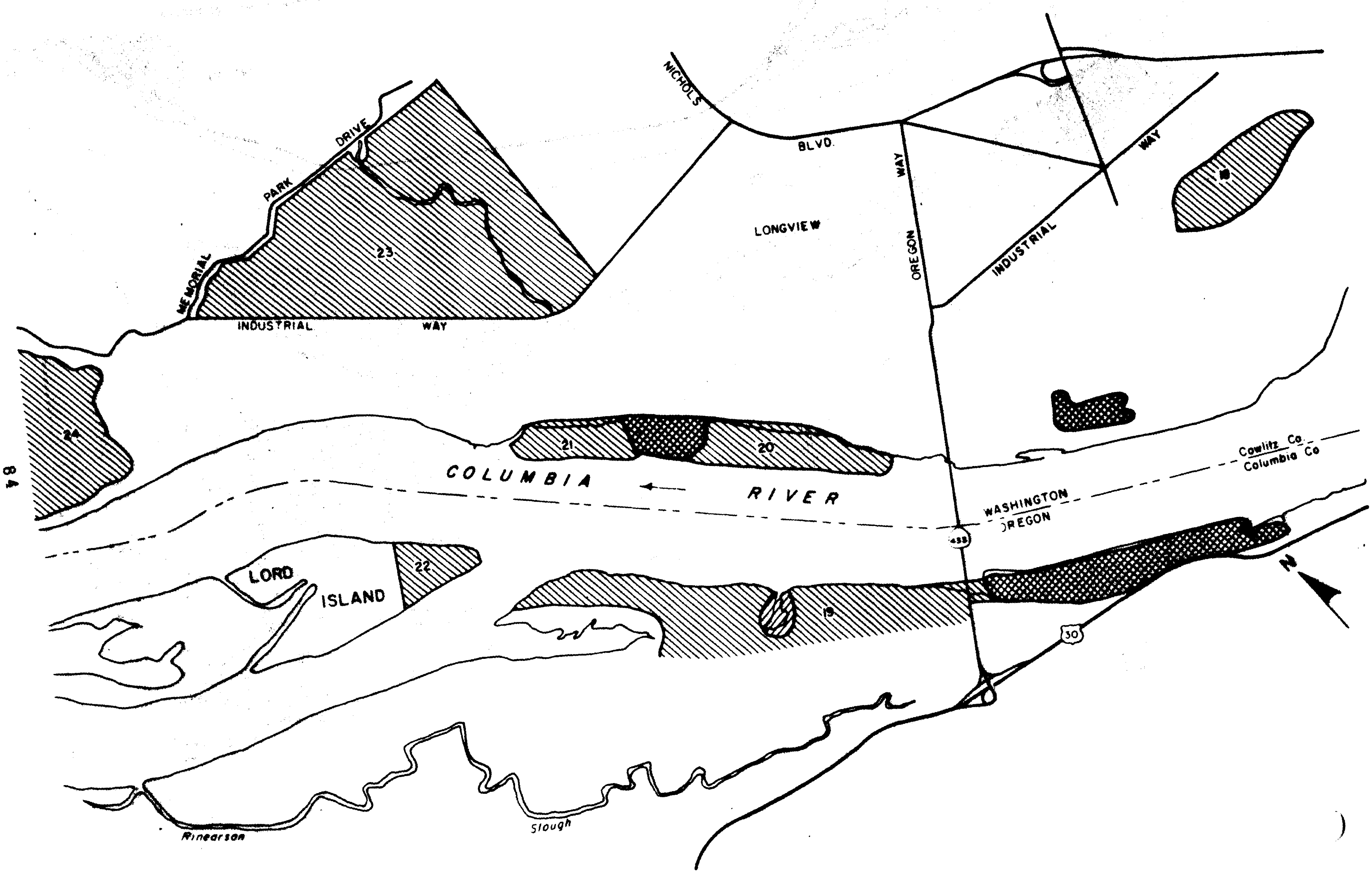

Figure 17 Dredge disposal sites.

- Proposed long-term sites

...d as of September 1984

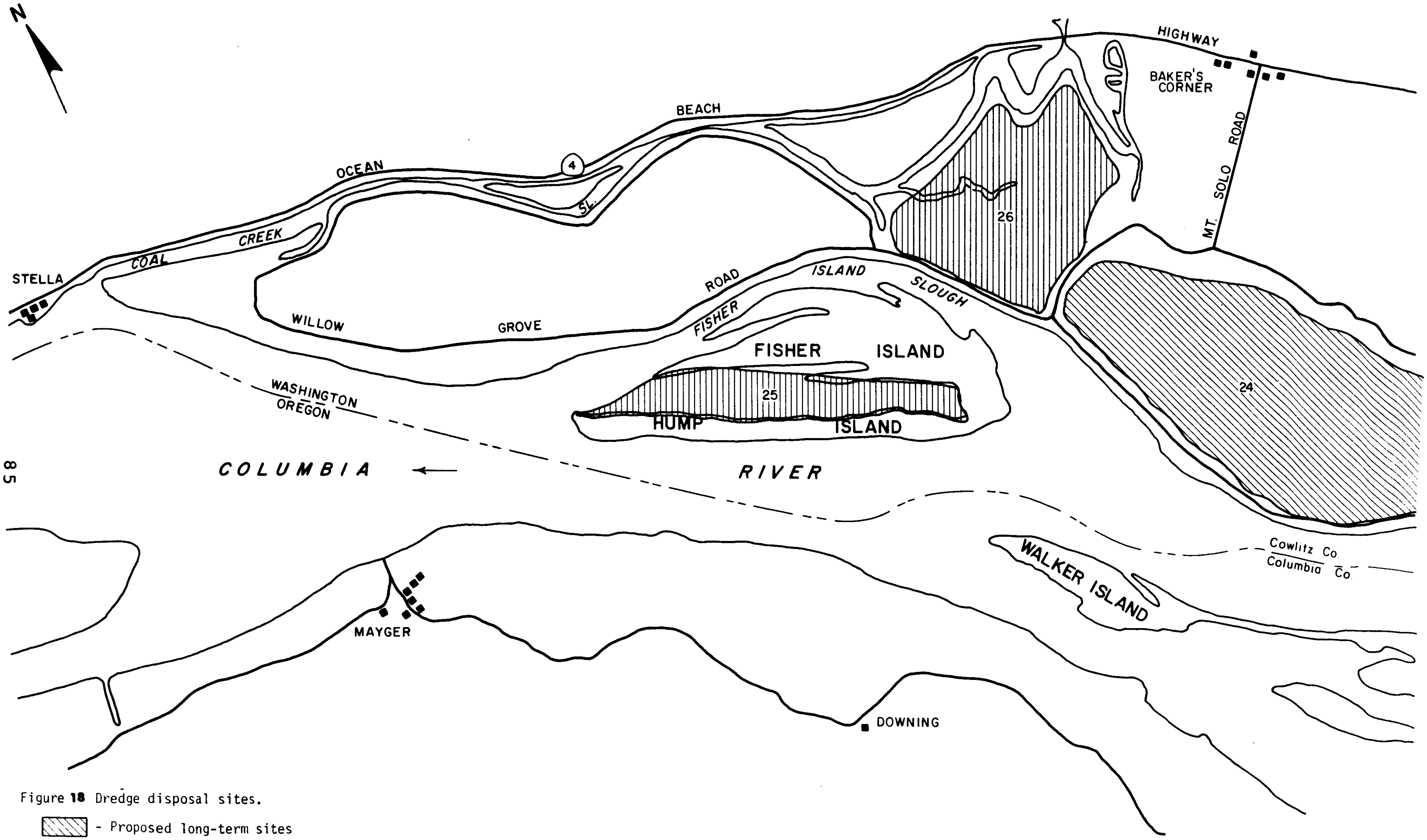

Figure 18 Dredge disposal sites.

- Proposed long-term sites
- Used as of September 1984
- Proposed mitigation sites

The Cowlitz sump probably would only be operated until 1989 or 2 years after construction started on the dam. Based on previous experience, no additional dredging should be necessary in the Columbia unless a storm event occurs in the first 5 years. Disposal requirements accordingly are reduced to approximately 3 mcy/year for normal Cowlitz Sump dredging.

Acceptable sites designated for use the first 5 years (1984-88) are 3, 9, 10, 11, 12, and 18. These sites have a combined capacity of 19.3 mcy. This should be more than adequate for normal dredging and leave some reserve for a storm event. Identified acceptable downstream areas are sites 2, 15, 19, 20, and 22. Total capacity of these sites is 55.2 mcy. Additionally, two sites used previously have the ability to take more material. Site 5 is not completely filled. A site on the west side of the Cowlitz between the highway and railroad, has had material removed and could be used again.

Sites 9 and 10 have been selected as the disposal site for the sump dredging for the winter 1984-85. It is expected that the winter 1985-86 material will be placed in site 9. The Port of Kalama estimates site 3 would hold 7.5 mcy.

Another modified HEP was conducted on the Collins Estate. The analysis was not continued any further, but it can be used to determine mitigation requirements on those sites requiring it; i.e. 9, 13, 15, 18, 19, 23, and 24.

THREATENED AND ENDANGERED SPECIES

Bald eagles are not infrequently seen in the Longview/Kelso/Rainier area. There is a known nest site on the bluffs above the Oregon shore around RM 60. Bald eagles occasionally feed at the mouth of the Cowlitz River in Carrolls Channel and at the mouth of the Kalama River. The estuary has significant populations of bald eagles, where there are a number of nest sites on both sides of the river. The estuary is also a winter roost area. There are no known endangered or threatened plants or candidate species in the Columbia River area. However, no surveys for these species have been made.

DISCUSSION

The Green River structure is the least damaging of the proposed sediment retention dams primarily because of its upstream location in the Toutle River System. The LT-3 and Kid Valley sites are unacceptable alternatives because they would cause extensive losses of fish and wildlife resources. While losses would not be as severe with the Green River Dam, sediment inundation of important fish and wildlife habitat would occur as a result of the dam. Dredge disposal, while not as extensive as with the "no action" alternative, would still involve significant loss of wildlife habitat. Mitigation for these losses would be necessary and should be considered a project cost.

There are several opportunities and/or methods to mitigate for the project-related losses of fish and wildlife described above. Fish passage to tributaries upstream of the Green River structure, fish habitat improvement, streambank revegetation, reseeding of dredged disposal areas, and provision for public access must be considered as mitigation measures. Specific measures could be used singly or in combination to achieve full replacement of lost fish and wildlife habitat.

Continued protection of fish and wildlife throughout the life of the project will be needed. Making fish and wildlife an authorized purpose of the project will help to accomplish this goal. One method of assuring protection of these resources is to monitor construction contracts and impacts.

A monitoring program will also be necessary to assess the adequacy of mitigation measures for fish and wildlife affected by the project. Monitoring could also be used to determine a "release schedule" from Spirit Lake and to adjust management of project lands. A 25-year monitoring program consisting of 5 years of continuous monitoring with periodic monitoring at 5-year intervals to year 25 amounts to a total of about $840,000. The fish and wildlife monitoring program should include studies of the following topics:

a. Water quality

b. Streamflow

c. Fish population recovery as effected by the project

d. Aquatic food chain recovery as effected by the project

e. Stream habitat recovery upstream and downstream of the project

f. Rearing pond site evaluations

g. Fish passage success

h. Wildlife studies should include monitoring of wildlife responses to project features within the study area.

A more specific discussion of project-related mitigation measures by stream system is presented in the following paragraphs.

TOUTLE RIVER

Since the upper Toutle River System formerly supported large runs of anadromous fish and will again provide habitat for these fish after streams have recovered, passage facilities are desirable for any barriers that are constructed to trap sediment. Passage would be needed for downstream migrating juvenile salmonids as well as upstream adult migrants. Since the Green River structure is the most efficient of the dam alternatives, in terms of sediment trapping and minimization of habitat losses, the following description of fish passage facilities is specific to this site. With regard to juvenile fish passage, the ideal situation would be to have a full pool and a spillway discharge over which the fish would be transported. However, a full pool may not be possible nor advantageous if warm impounded water becomes a water quality problem downstream. Preliminary information on the design of juvenile fish facilities indicates that a regulating outlet (RO) in the dam will permit the fingerlings to pass through the dam and into a stilling basin. As sediment depth increases behind the dam, stoplogs inserted upstream of the RO trashrack, will force the water with the juveniles to drop into a wet well located just upstream of the RO. The juvenile migrants would then pass through the RO to the tailwater.

Successful passage of juvenile salmonids would require suitable conditions in the main stream channel and in tributaries upstream of any dam where sediments and ponded water would collect. These conditions include low summer water temperatures and a defined stream channel. It is

expected that flat alluvial deltas would form where sediments accumulate behind dams. The North Fork Toutle River is likely to form numerous braided shallow channels in such areas. These conditions could cause: 1) stranding of juvenile fish when river levels drop; and 2) warming of waters to lethal temperatures for salmonids. Fish passage conditions and water temperatures could be improved by confining the river to a single deep channel through the sediment collection area during the time of juvenile salmonid migration. Annual dredging may be necessary to provide such a channel.

Passage of upstream migrating adults could be accomplished by trapping and hauling adult fish around the dam. A trap and haul system would require the following structural features: 1) a holding pond and fish handling facilities; 2) a fishway entrance to the holding pond; 3) a velocity barrier or weir to direct fish into the fishway entrance; and 4) suitable vehicles to transport fish from the holding pond to a liberation point. A trap and haul system would require continued maintenance of the weir and fish holding facilities and transportation of fish. Estimates of the cost of a trap and haul operation are $1,000,000 with an annual maintenance cost of $100,000 (Appendix C).

Certain measures would also be necessary to avoid or lessen fish losses during project operations. These measures could include the following: 1) proper timing of inwater work to avoid major periods of fish migration; and 2) maintenance of an adequate stream channel through work areas to permit passage of adult fish and to prevent stranding of smolts.

Fish required to replace lost stocks could be produced at new or existing facilities, either inside or outside of the Toutle River Basin. Construction of rearing ponds to replace the Alder Creek and Deer Springs facilities would require a suitable location and source of water. Suitable rearing pond sites may or may not exist within the Toutle Basin. It may, therefore, be necessary to locate such facilities in adjacent or nearby river systems such as the Lewis or Cowlitz Rivers.

Rehabilitation of the Toutle Salmon Hatchery may also be performed when water quality and supply conditions become suitable for fish culture operations. It may be anywhere between 5 and 15 years before the hatchery is again functional, however. Therefore, cost estimates have not been provided for reopening the Green River facility. The decision to reopen the hatchery will depend largely on restoration of the watershed in terms of riparian vegetation and instream habitat conditions.

Fish losses associated with inundation of valuable habitat upstream of the Green River structure are estimated at \$25,095,000 over the life of the project. Of this amount, \$4,349,000 are due to loss of production in Alder, Bear, Deer, Hoffstadt, and Pullen Creeks over this period. Estimates of fish benefits due to recovery of habitat in the mainstem Toutle and North Fork Toutle River downstream of the structure amount to \$18,845,000. Therefore, overall losses attributable to the Green River Dam are estimated to be \$6,250,000.

Improvement of stream habitat could be used to offset losses caused by the dam. This could be accomplished by the following means: 1) stream temperature control; 2) sediment and erosion control; and 3) instream habitat improvement.

Stream temperature control could be achieved by establishing and retaining shade-providing vegetation along streams. This could be accomplished by any or all of the following measures: 1) reestablishment of trees, shrubs, and other plants along streams which presently lack riparian vegetation; 2) establishment of permanent buffer zones of vegetation along streams; and 3) easements for streamside buffer zones on privately owned lands.

Streams which are likely candidates for rehabilitation with riparian plantings include the upper portions of Miners and all of Schultz Creeks, tributaries of the Green River. WDF and Weyerhaeuser have already initiated revegetation of Elk Creek, another Green River tributary, with flowering dogwood, wild rose, and cottonwood (Mohoric, personal communication). Similar measures in other Toutle Basin streams would help to mitigate for losses of fish habitat upstream of the Green River Dam. Other candidate streams for riparian plantings include Disappointment, Trouble, Goat, and Dollar Creeks on the South Fork Toutle River. Approximately 1 square mile of riparian habitat could be restored with this measure. Costs associated with this measure are estimated to be \$82,000.

Control of erosion and sedimentation could be accomplished by many of the same measures used to reduce stream temperatures. These include revegetation of streambanks and establishing buffer zones of riparian vegetation. In addition, structural measures could be implemented to control streambank erosion. These include stabilization of eroding streambanks with rock riprap, groins, or jetties.

Instream fish habitat could be restored or improved at many locations in the Toutle River System. Placement of boulders, gabions, or large organic debris such as logs or root wads would hasten stream habitat recovery by providing a diversity of pools, riffles, and instream cover for fish. Such activities have already been started, but could be expanded to other streams in the basin. Gravel cleaning to remove fine sediments would improve available spawning areas for fish. Revegetation of streambanks would provide a nutrient base for aquatic insects and overhead cover for fish. Instream rehabilitation in 20 miles each of the mainstem Green and South Fork Toutle Rivers should be considered as mitigation for the loss of 9 miles of productive habitat ($4,349,000 value) in Alder, Bear, Deer, Hoffstadt, and Pullen Creeks and 5 miles of the North Fork Toutle River. Placement of woody debris, gabions, or boulder grouping in these rivers would cost between $60,000 and $212,000, depending on the stream rehabilitation method used. Other streams downstream of the dam (see following paragraphs) may also be suitable for restoration work.

Potential spawning and rearing habitat for anadromous fish exists upstream of impassable water falls in the Green River and other Toutle System streams. Fish passage could be provided around such obstacles to offset losses of spawning and rearing habitat caused by sediment inundation upstream of the Green River Dam. Passage could be provided by blasting the falls to reduce their gradient, selective blasting to provide a passage channel, or constructing fish ladders (Plate 6). Passage improvement sites exist at Thirteen Creek Falls (near the mouth), Devils Creek (blasting-cutting above the #500 road bridge), and at an unnamed South Fork tributary (Section Lines 22 and 23, T9N, R2E). These improvements, i.e. ladders at Thirteen Creek and at the South Fork tributary and blasting at Devils Creek, would open an additional 7 miles of spawning and rearing habitat for coho salmon. Costs for these improvements are estimated to be about $101,000.

Wildlife habitats upstream of the proposed SRS should be maintained as long as possible, both in the sediment inundation zone and in the buffer zone (i.e., throughout the 7,450 acres). This includes maintenance of habitat conditions outlined in Figure 9. Most importantly this should include cessation of timber harvest. Debris and trees killed by sediment inundation should remain to provide snags for wildlife. Debris should be removed only on an as needed basis to protect the SRS. As this material moves downstream, it will help to stabilize the riverbed, provide instream habitat,

Plate 6. Elk Creek before fish passage was improved. Available habitat for anadromous fish could be increased by improving fish passage at waterfalls.

and act as a detrital nutrient source. Land owned by the CE behind the SRS that will not be inundated by sediment should also be maintained for wildlife throughout the life of the project. Maintenance of these lands will partially offset habitat losses due to sediment inundation.

As dredge disposal proceeds, creation of varying contours, seeding, and fertilizing will provide conditions suitable to wildlife habitat development. This is particularly applicable to downstream areas LT-1 and LT-3. Contouring disposal material to favor wetland development and herbaceous and woody plantings would hasten recovery after disposal. (Some wetland re-creation has already been attempted with some success along the Columbia River by the Portland CE). Almost all the land within LT-1 and some of the land at LT-3 is owned by the state. The Washington Department of Natural Resources (DNR) has indicated a willingness to consider maintenance of some areas for wildlife after disposal and the above mitigation measures are implemented. Although portions of these lands may ultimately be developed for recreation (e.g. picnicking and fishing access), maintenance of wildlife habitat need not be imcompatible with these uses (Smith, personal communication). Further coordination as disposal is placed and the DNR finalizes plans for these areas is needed.

The CE Waterways Experimental Station has developed guidelines on material placement for marsh creation (Johnson and McGuinnes, 1975) which should be used in dredge disposal material placement. Costs associated with this measure are about $98,300.

To offset loss of habitat covered by sediment at the SRS site, the area should be periodically reseeded (i.e. throughout the life of the project). A Dutch white clover/orchard grass/red clover/ red fescue mix with a fertilizer application of 100 lbs. of 10-20-20 per acre should be used. Liming may also be necessary in some instances.

Woody plantings such as ninebark, huckleberry, salal, and Oregon grape should be planted in areas outside the sediment zone but within CE ownership to offset forage losses in the sediment retention zone. This should also include expansion and maintenance of existing herbaceous vegetation, including fertilization at the base of the debris slope (outside the National Volcanic Monument). Seeding of the debris slope will offset losses of elk feeding areas within the project area. Following project completion (50 years), the entire area should be seeded and planted to hasten recovery.

Temporary protection or easements along the Green River, South Fork Toutle River, and Hoffstadt Creek drainages should be considered to offset habitat losses before final mitigative measures begin. Specifically, this should include cessation of timber harvest. This protection would be dropped as mitigation measures are implemented.

While it is recognized that stabilization of the Toutle River downstream from the project will speed recovery of riparian vegetation, we do not believe this improvement can be quantified. As a result, it is not specifically included in our mitigation analysis.

COWLITZ RIVER

Construction of the sediment retention structure project will enable the Cowlitz River to begin to return to pre-eruption conditions within a relatively short time. In addition to the structure, there are other actions which can be taken to accelerate the recovery process.

A major source of continued sediment flow will be lateral instability of the Cowlitz River. As soon as possible after sediment flow from the debris avalanche is halted, steps should be taken to stabilize the Cowlitz. This would be particularly suitable in areas where the river is not tightly confined between levees or riprapped areas. Willow, alder, and cottonwood shoots can be placed in low velocity areas. Bank areas could be seeded with grasses and legumes, with a program of annual fertilization. Reestablishment of riparian habitat would help prevent lateral erosion, provide temperature modification, insect and detrital input for aquatic species, and food and cover for terrestrial species.

Several actions could be taken to restore wildlife habitat. During the final deposition at a particular spoil site, especially those owned by the State of Washington and adjacent to the river, the spoil area should be shaped with irregular contours, both vertically and horizontally. Revegetation of sand at other dredge disposal locations has shown that grasses get a better start in depressions. Disposal areas should be seeded with appropriate grasses and fertilized annually. After a humus layer has begun to form, shrub and tree species could be planted to provide wildlife habitat. The Cowlitz County SCS agent and WDG should be consulted regarding species, grass mixtures and rates, and fertilizer rates.

Public access to the river for fishing and viewing should also be provided on these disposal sites.

COLUMBIA RIVER

The alternatives with the least impact on Columbia River fish and wildlife would be the Single Retention Structures which retain all of the sand size and larger material. Included are Kid Valley, height 318 and Green River, height 177, 202, and 272. Green River heights 177 or 202 are the preferred alternatives for the Columbia system. This, along with PL 98-63 actions and Cowlitz Sump, will allow the least amount of sand size sediment into the Columbia River. It would also minimize the dredging and disposal requirements for maintaining navigation and would reduce the deposition of sediment in shallow water areas and in the Columbia River Estuary. However, since the dams are not designed to retain fines, there is little that can be done to reduce the impact of deposition of fines in the estuary and other shallow water areas.

Inwater disposal sites should be located where the least amount of material would be deposited in highly productive shallow water areas. Sumps could be located in other places, such as off Barlow Point. Material from this sump could be placed in disposal site 24.

Our prioritized list of disposal sites at the mouth of the Cowlitz is as follows: 3, 1, 5, 11, 10, 2, 18, 15, 9, and 13 (Figures 16 and 17). Mitigation has already been agreed upon for the loss of wetlands at site 3. The Port of Kalama has in the past offered to pay the difference in the cost of pumping to this site. Site 9, which is presently being used, was given a low priority because the requested mitigation planning for this site has not been initiated. However, this site would be considered acceptable with implementation of appropriate mitigation actions. The first 6 sites on this prioritized list would provide 62.3 mcy capacity, which is more than adequate for the preferred plan.

Mitigation requirements for those sites that are acceptable with mitigation should be determined using HEP. Mitigation should be determined for individual sites through coordinated planning by the resource agencies, the Corps, the project sponsor, and affected landowner. Mitigation requirements and an agreement as to how they are to be met should be agreed upon before any of the sites are used.

Mitigation options are limited in the area. The major habitat types of concern are emergent wetlands and mature forested. First priority would be to create wetlands to replace those lost. Restoration of detrital input into the Columbia River system is particularly important. There are 2 possible wetland creation sites. One would be to enlarge the existing site on Carrolls Channel. At least 3.6 acres of wetland could be created. Site 25 is another possible wetland creation site. Because of its value to juvenile salmonids, this area should be only partially filled. An estimated 60 acres of wetlands could be created along Fisher Island and at its upstream end. This action would be consistent with the Cowlitz County Comprehensive Plan and the Shorelines Management Master Plan. The log rafting area at this site is leased to Knappton Corporation. Consideration for that use would have to be addressed during development of a wetland creation plan. Fill needed to create the wetland could be obtained from channel maintenance dredging or from maintenance dredging of the Longview waterfront.

Preservation of existing wetland or wildlife habitat should be considered as a mitigation option. This could be accomplished by outright purchase, deeding to wildlife uses or easements. Two possible sites are 4 and 26. Both of these areas are moderate to high value habitat, but have some possibilities for increasing values. It is this increase in habitat value, not preservation alone, that provides mitigation credit. Parts of site 4 have already been designated as mitigation for two developments by the Port of Kalama. Site 26 is owned by the Port of Longview, a project sponsor. Wally's cove, a 4-acre wetland in site 19, was filled last fall. Mitigation for loss of this wetland is possible in the slough at the downstream end of the site.

A task group of resource agencies, the Corps, project sponsors, and the county should be formed to determine detailed mitigation requirements, mitigation sites, and actions to be taken. It had not been possible to do this earlier due to time constraints and delay in receipt of project data from the Corps. Now that an alternative has been selected, a more definite idea can be formed of disposal sites which are feasible to use, i.e. are available, are environmentally acceptable, etc.

The task group should be formed as soon as possible to begin working on mitigation plans. The HEP should be completed for additional disposal sites and proposed mitigation sites, so

that specific mitigative actions can be determined. It is expected that this can be done concurrently with detailed planning for the structure at an estimated cost of $50,000. Portions of the mitigation plan should be implemented immediately to offset habitat losses as most of the losses will occur in the next 5 years.

The cost to mitigate for the impacts of dredge spoil disposal would be determined in developing the detailed mitigation plan. However, based on the cost of mitigation actions undertaken in similar situations, they would be expected to range from about $250,000 to $1.5 million for the impacts to riparian and wetland habitat from dredging at the mouth of the Cowlitz River. At the low end of this range, it is assumed that mitigation can be accomplished on an available land base through management of vegetative cover and relatively minor control of water levels. The high end of this range assumes that mitigation lands would have to be acquired and significantly modified through changes in elevation and structural control of water levels. Obviously, mitigation costs for dredge spoil disposal can be minimized simply by careful consideration of the disposal location and impacts. The prioritization of disposal sites as discussed herein has been developed accordingly.

A summary of costs associated with all recommended mitigation measures is contained in Table 15.

Table 15. Estimated Costs for Mitigation Measures Associated With the Proposed Project

Mitigation Action	Time Period	Cost
Instream Work:		
Gabions	Year 1-10	$ 90,000
Woody debris placement	Year 1-10	60,000
Boulder groupings	Year 1-10	212,000
Passage:		
Blasting	Year 1-10	500
Ladders (2 streams)	Year 1-10	100,500
Trap and haul	Year 1	1,000,000
O&M	Varies	100,000
Riparian Plantings:	Year 1-10	180,000
Monitoring:		
Continuous for 5 years with periodic monitoring every 5 yrs. to year 25	Year 1-25	840,000
Habitat Replacement:		
For dredge spoil disposal		250,000-1,500,000

RECOMMENDATIONS

The following recommendations are based on information provided by the Corps of Engineers describing the preferred alternative at the Green River site and the interim dredging activities downstream of the dam. Based on the severity of their adverse impacts to fish and wildlife, as detailed in the text, the LT-3 and Kid Valley dam sites (both MRS and SRS) are not acceptable. The Green River structure appears to be the least damaging alternative; however, mitigation must be provided for the losses of fish and wildlife habitat caused by this structure. Preferred dredged material disposal sites have also been identified which would minimize adverse impacts to fish and wildlife as well as associated mitigation requirements.

Recommendations are presented in two sections--General and Specific. General recommendations would apply to all lands and waters in the affected study area. Specific recommendations address particular aspects of fish and wildlife mitigation in the Toutle, Cowlitz, or Columbia River Systems.

GENERAL RECOMMENDATIONS

It is recommended that:

1. If a SRS is considered necessary, then the Green River site be given preference for construction of a dam. The LT-3 and Kid Valley sites should be rejected because dams at these sites would produce unacceptable losses of fish and wildlife resources and habitat.

2. Fish and wildlife be made an authorized purpose of the project to ensure that action is taken to plan and implement appropriate mitigation measures.

3. In keeping with the requirements of the Fish and Wildlife Coordination Act, all capital and operation and maintenance costs for fish and wildlife mitigation be treated as an "integral part of the cost of the project."

4. All lands, water, and interests therein to achieve mitigation goals be acquired by the federal construction agency as stipulated in Section 3(c) of the Fish and Wildlife Coordination Act.

5. Necessary fish and wildlife studies and associated funding be included in any future authorization for the preferred alternative.

6. The Corps of Engineers provide funds to fish and wildlife agencies to monitor construction impacts and the effectiveness and adequacy of mitigation programs for fish and wildlife. Approximate costs for a 25-year study which includes 5 years of continuous monitoring with periodic monitoring at 5-year intervals for 20 years thereafter amount to $840,000. A monitoring program for fish and wildlife should include studies of the following topics.

   a. Water quality

   b. Streamflow

   c. Fish population recovery as affected by the project

   d. Aquatic food chain recovery as affected by the project

   e. Stream habitat recovery upstream and downstream of the project

   f. Rearing pond site evaluations

   g. Fish passage success

   h. Wildlife studies should include monitoring of wildlife responses to project features within the study area.

   Fish and Wildlife monitoring would be done concurrently and in cooperation with the Corps' 25-year project monitoring efforts.

7. The Corps of Engineers modify mitigation measures if results of monitoring studies find such changes to be warranted.

8. Construction and non-emergency dredging activities be scheduled to protect fish and wildlife (i.e., inwater work periods, etc.). Construction techniques to protect fish and wildlife as specified by federal and state resource agencies should be incorporated in construction contracts. Contract inspection efforts should include participation by fish and wildlife biologists. This is estimated to cost $80,000 annually over the 2-year construction period. This amount is included in the monitoring program cost detailed in Recommendation 4.

9. Existing habitats of high value to wildlife not be used as disposal sites for dredge spoils.

10. Areas of lower value to wildlife such as diked pasture and/or old dredge spoil disposal sites be used for dredge spoil disposal.

11 Herbaceous and woody vegetation be established on dredge spoil areas immediately after spoil is deposited.

12. Wetland creation in dredge spoil areas be investigated and implemented where feasible.

13. Loss of important fish and wildlife habitat due to project impacts be mitigated by development and/or improvement of other areas.

14. The property behind the Green River structure be managed for fish and wildlife and recreational uses thereof.

SPECIFIC RECOMMENDATIONS

Toutle River

It is recommended that:

1. Successful passage be provided for anadromous fish at all barriers erected to trap sediments. Passage would be required for downstream migrating juvenile salmonids and adult fish moving upstream. Planning for and final design of such mitigation facilities must be approved by the resource agencies prior to construction of any sediment retaining structure. A trap and haul facility for adults would cost an estimated $1,000,000 in addition to annual operation and maintenance costs of $100,000. Downstream passage costs are not available.

2. When feasible, a single defined stream channel be maintained in summer through impounded sediments to improve adult and juvenile fish passage.

3. A stream channel designed to permit fish passage and prevent stranding of adult and juvenile salmonids be maintained through all work areas (including the LT-1 and LT-3 dredging sites).

4. Rearing ponds be constructed to mitigate losses of Alder Creek and Deer Springs fish facilities inundated by sediment.

5. Riparian and instream habitat be improved at project cost at sites downstream of the Green River Dam to mitigate for project-related losses of instream and riparian habitat. Possible sites for riparian plantings include Disappointment, Trouble, Goat, and Dollar Creeks at a cost of about $82,000. These restoration measures should be implemented concurrently with the 2-year dam construction period. Suitable instream habitat improvement sites include, but are not limited to, the mainstem Green and South Fork Toutle Rivers, Devils and Thirteen Creeks, and at an unnamed South Fork tributary (Section Lines 22 and 23, T9N, R2E). Costs for the mainstem work would range from $60,000 to $212,000 and for the passage improvements about $100,000. The final selection of suitable mitigation measures and sites should be accomplished through a coordinated planning effort involving the Corps, affected landowners, public land management agencies, and fish and wildlife agencies.

6. Wildlife habitat within the sediment storage area upstream of the SRS be maintained as long as possible. Lands outside the sediment inundation zone, but within Corps ownership, should also be maintained for wildlife. Timber harvest should cease on this land to minimize the impact of wildlife lost gradually over the 50-year project life.

7. The LT-1 and LT-3 disposal sites be finished in irregular contours, seeded, planted to woody vegetation, and fertilized to aid in erosion control and development of wildlife habitat. Costs associated with vegetative plantings are about $98,300.

8. Periodic seeding and fertilization of the sediment inundation area with Dutch white clover, orchard grass, and red clover mix continue throughout the life of the project.

9. Elk forage such as ninebark, huckleberry, salal, and Oregon grape be planted on Corps lands outside the sediment inundation zone to replace forage lost to sediment coverage.

10. Existing herbaceous vegetation be maintained at the base of the debris avalanche. Any part of the seeded debris avalanche which is under Corps ownership should be maintained to benefit deer and elk.

11. Temporary protection of existing riparian vegetation along the Green River, North Fork Toutle River, and upper Hoffstadt Creek drainages be established to offset wildlife habitat losses within the sediment inundation zone. The major action needed would be cessation of timber harvest in the riparian zone. This protection would begin at the time of project construction and would be dropped as mitigation is implemented. Specific actions should be developed through a cooperative planning effort involving the affected landowners and fish and wildlife agencies.

Cowlitz River

It is recommended that:

1. Disposal areas be finished in irregular contours to increase habitat diversity.

2. Eroding streambanks and dredge spoil disposal areas be fertilized and revegetated immediately with herbaceous and woody plants.

3. Public access be provided to State owned or managed disposal areas.

Columbia River

It is recommended that:

1. As much bedload material as possible be kept out of the Columbia River System, and especially the estuary by:

    a. Operation of the Cowlitz River Sump;

    b. Establishment of sumps in the Columbia where there are adequate upland disposal sites.

2. In-water disposal sites for dredge spoils be located where material would not be deposited in shallow water areas or entrances to sloughs and backwaters.

3. Dredged materials be disposed of in the following sites in order of priority; 3, 1, 5, 11, 10, 2, 18, 15, 9, and 13 (Figures 16 and 17).

4. Mitigation for habitat values lost be required before use of sites 2, 9, 13, 15, 18, 19, 23, and 24. Assuming that

some of these sites are used for dredge spoil disposal, the estimated mitigation cost for this measure would range from $250,000 to $1.5 million.

5. A plan be developed under the authority of the Fish and Wildlife Coordination Act which identifies specific actions needed to mitigate for impacts of dredging and dredge material disposal. This plan should be guided by a task group of interested agencies, and should be developed to address both short- and long-term dredging needs and concerns. The plan would cost an estimated $50,000 and should be developed concurrently with detailed planning for project facilities (approximately 12 months). As the construction agency, the Corps would be responsible for implementation of mitigation measures identified through this planning process. These measures should be implemented concurrently with project dredging activities.

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APPENDIX A. Basis for Calculations Used to Estimate Chronology and Value of Fish Recovery

SPRING CHINOOK*

PRELIMINARY ESTIMATE OF RECOVERY CHRONOLOGY

Year	Adults
1983	20
1988	50
1993	150
2020	500

POTENTIAL RECOVERY VALUE

Catch: Escapement 3:1 - 375:125

43% Commercial	(161)	x $34.80	=	$ 5,611
57% Sport	(214)	x $295	=	63,056
		TOTAL		$68,667

* The values expressed above only signify potential natural production could be increased 20 times when Washington Department of Fisheries reopens their Deer Springs rearing ponds.

CUTTHROAT

	Area (M^2)		Adults*
Hoffstadt	132,312		794
Bear	49,054		294
Deer	25,753		154
Jackson	18,640		112
Castle	29,432		177
Coldwater	51,507		309
Alder	51,507		309
Other tributaries	49,054		294
North Fork Toutle	441,486		441
		TOTAL	2,884

* Estimated at 6 smolts/100m^2 except main North Fork where 1 smolt/100m^2 and 10% smolt/adult survival

POTENTIAL RECOVERY VALUE

Catch: Escapement 2:1 - 1,923:961
100% Sport (1,923) x $36 = $69,228

PRELIMINARY ESTIMATE OF RECOVERY CHRONOLOGY

Year	Adults
1983	50
1988	250
1993	400
1998	600
2020	2,884

COHO

	Area (M^2)		Adults*
Alder	23,161		718
Hoffstadt	24,642		764
Bear	49,054		1,521
Deer	8,870		275
Jackson	18,639		578
Castle	29,432		912
Coldwater	51,506		1,598
Other tributaries	49,054		1,520
North Fork Toutle	354,816		10,999
		TOTAL	18,885

* Estimated at .31 smolts/m^2 (3/100m^2) and 10% smolt/adult survival

POTENTIAL RECOVERY VALUE

Catch: Escapement 7:1 - 16,524:2,361
64% Commercial (10,575) x $8.98 = $ 94,964
36% Sport (5,949) x $107. = 636,504

TOTAL $731,468

PRELIMINARY ESTIMATE OF RECOVERY CHRONOLOGY

Year	Adults
1983	100
1988	150
1993	650
1998	1,027
2020	18,885

STEELHEAD

	Area (M^2)	Adults*
Hoffstadt	132,312	318
Bear	49,054	118
Deer	25,753	62
Jackson	18,640	45
Castle	29,432	71
Coldwater	51,507	124
Alder	51,507	124
Other tributaries	49,054	118
North Fork Toutle	441,486	1,060
	TOTAL	2,040

* Estimated at 4 smolts/100m^2 and 6.0% smolt/adult survival

POTENTIAL RECOVERY VALUE

Catch: Escapement 3:1 - 1,530:510
100% Sport (1,530) x $214 = $327,420

PRELIMINARY ESTIMATE OF RECOVERY CHRONOLOGY

Year	Adults
1983	50
1988	150
1993	250
1998	450
2020	2,040

POTENTIAL PRODUCTION ABOVE THE SRS

FALL CHINOOK

	Area (M^2)	Adults*
Alder	23,161	602
Hoffstadt	24,641	640
Bear	49,054	1,275
Deer	8,870	230
Jackson	18,640	485
Castle	29,432	765
Coldwater	51,507	1,339
Other tributaries	49,054	1,275
North Fork Toutle	354,816	9,225
	TOTAL	15,836

* Estimated at .26 smolts/m^2 (2.6 100m^2) and 10% smolt/adult survival

POTENTIAL RECOVERY VALUE

Catch: Escapement 6:1 - 13,574:2,262
80% Commercial (10,859) x $34.80 = $377,893
20% Sport (2,715) x $107. = 290,483

TOTAL $668,376

PRELIMINARY ESTIMATE OF RECOVERY CHRONOLOGY

Year	Adults
1983	50
1988	75
1993	125
1998	2,000
2020	15,386

APPENDIX B. Habitat Evaluation Procedure

The Habitat Evaluation Procedures (HEP) were developed as a tool for evaluating project impacts and as a basis for formulating recommendations for mitigation. The HEP were used to evaluate the Green River SRS project impacts and mitigation needs.

Pre-field activities consisted of selecting an evaluation team (representatives from the Washington Department of Game, Corps of Engineers, and Fish and Wildlife Service participated) cover mapping, and evaluation species selection. Team members evaluated baseline habitat values in the field for the evaluation species and determined future habitat conditions for the life of the project (50 years). Habitat values were annualized to depict changes in habitat value over time, (such as dredge material disposal at LT-1 or sediment in-filling at the SRS). Impact analysis identified losses over time. Compensation plans were developed based upon the estimated habitat losses.

Two scenarios were developed for the Green River project site: 1) future conditions at the project site without the project and 2) future conditions at the project site with the project. Details of the predicted future conditions are included in Appendix B. Essentially, the future without condition assumed no major changes in land use from the present. Commercial timber harvest would continue on most of the area and natural succession would continue in areas not affected by timber harvest. The LT-1 and LT-3 sites would still receive dredge disposal (in accordance with flood control and navigation requirements outlined in PL 98-63). Minimal to no artificial revegetation would occur at these sites.

The future with the project condition included project features to offset wildlife habitat losses and was calculated using the preferred CE alternative (965 feet elevation, spillway height 177 feet, real estate purchase of 7,450 acres). This future condition assumed habitats would be maintained as long as possible behind the structure (e.g. cessation of timber harvest before and after purchase by the federal government). Herbaceous plant seeding would occur periodically throughout the life of the project at both the SRS sites and at downstream disposal sites. Dredge disposal at the LT-1 and LT-3 sites would be contoured to create wildlife and wetland habitats. Trees would be planted to hasten recovery at LT-1 and LT-3.

PROJECT WITHOUT CONDITIONS

Green River SRS Site

In Target Year 1

All cover types are assumed to be the same as baseline. Almost all land in the project area is publicly owned or owned by commercial timber companies. No major change in ownership is expected in the foreseeable future.

In Target Year 5

All cover types are expected to remain unchanged with the exception of the mature forest cover type. Mature Forest is expected to be harvested by TY 5 and be in reproduction forest. (See Managed Timber Harvest Schedule).

In Target Year 10

All cover types are expected to remain the same as baseline habitats with the following exceptions:

1. Mature Forest will be in reproduction age class with a mean HSI value for baseline reproduction forest.

2. Riparian Forest is expected to have been harvested and in a reproduction forest age class. HSI is expected to be comparable to a logged riparian site observed during baseline evaluation (Riparian #4).

3. Other Forest is expected to be harvested by this time and be in reproduction forest. Virtually all of the project area and surrounding area has been logged at one time or another. This trend is expected to continue.

In Target Year 25

1. Urban area is expected to double in size by this time. However, on an overall basis, urban growth is expected to be minimal.

2. Grassland/Pasture is not expected to increase. Most of these areas are associated with homes and small farms. The majority of land in the area is expected to remain in private timber company ownership or public ownership.

3. Reproduction Forest at baseline evaluation is now expected to be in pole stage (See Managed Timber Schedule); HSI will equal mean value for pole forest cover type. Acreage will remain at baseline levels.

4. Pole Forest type is expected to be reaching maturity. HSI will be the mean value for Mature Forest at baseline. Acreage is expected to remain the same.

5. Mature Forest type will be in Reproduction Forest (See Managed Timber Harvest Schedule). HSI values will equal baseline reproduction forest values. Acreage will be the same as baseline.

6. Riparian Forest will be in pole and slightly older stages. HSI will be comparable to Riparian Site #3, observed during baseline evaluation.

7. Barren cover type is reduced based upon predicted natural succession assumptions. It will be reduced by 1/4.

8. Disturbed Revegetated habitat will be increased by the acreage Barren cover type is reduced.

<u>In Target Year 50</u>

1. Urban area will have doubled in size; HSI value will be the same as baseline.

2. Grassland/Pasture acreage will remain same as baseline and HSI will remain same as baseline. Most land in the area is owned by timber companies, or publicly owned; private holdings are not expected to increase.

3. Reproduction Forest is expected to be in pole stage (See Managed Timber Harvest Schedule); HSI will be equal to HSI for Baseline Pole Forest. Acreage will be same as baseline.

4. Pole Forest is expected to have reached maturity before TY 50 and to have been replanted. (See Managed Timber Harvest Schedule). HSI will equal baseline reproduction forest. Acreage will be same as baseline.

5. Mature Forest is expected to have reached maturity before TY 50 and to have been replanted by TY 50 (See Managed Timber Harvest Schedule). HSI will equal baseline reproduction forest. Acreage will be same as baseline.

6. Riparian Forest is expected to be in late pole stage - early maturity; HSI will be comparable to riparian site seen on field studies (Riparian Forest Site #2). Acreage will be the same as baseline.

7. Forest Other - will be logged earlier (TY 10) and will be in Reproductive Forest.

8. Barren acreage is expected to be reduced by 1/2; HSI same as baseline (See Natural Succession Assumptions).

9. Revegetated will be increased by the amount Barren habitat is reduced; acreage is expected to be mature broadleaf forest; HSI will reflect Broadleaf site observed during field observation (BL #2).

PROJECT WITHOUT CONDITIONS

(PL 98-63) LT-1

<u>In Target Year 1</u>

Entire area will be covered with dredge disposal material; entire area will be barren. HSI will be same as mean HSI at baseline for Barren.

<u>In Target Year 5</u>

Entire area will be covered with dredge disposal material; entire area will be barren.

<u>In Target Year 10</u>

Dredge disposal in the area will have been completed. Approximately 1/2 of the area will be revegetated; HSI will be Disturbed Revegetated Mean HSI from baseline evaluation. Remaining area will be barren.

<u>In Target Year 25</u>

Approximately 3/4 of the area will be revegetated; 1/4 will be barren. HSI's for both cover types will equal baseline Mean HSI's.

<u>In Target Year 50</u>

All of the area is expected to be revegetated. HSI will equal baseline Mean HSI for Disturbed Revegetated.

PROJECT WITHOUT CONDITIONS

(PL 98-63) LT-3

In Target Year 1

Entire area will be covered with dredge disposal material; entire area will be barren. HSI will equal baseline HSI for Barren.

In Target Year 5

Entire area barren; same as TY 5/LT-1.

In Target Year 10

Dredge disposal will continue; entire area will be barren.

In Target Year 25

Dredge disposal will have been completed. Approximately 1/2 of the area will be revegetated, 1/2 barren.

In Target Year 50

Three-quarters of the area will be revegetated, 1/4 will be barren.

PROJECT WITH CONDITIONS

965 Elevation with 7500 Acres
Green River SRS Site

In Target Year 1

Project conditions are the same as baseline with the exception of 5 acres of developed habitat will be lost to Disturbed Revegetated (See Table 3 for acreages covered by sediment). All timber (pole stage and older) covered by sediment will become Mudflow Forest.

In Target Year 5

All cover types not covered by sediment are the same as baseline. Approximately one-half of the acreage covered by sediment will be seeded. Amount reseeded will become Disturbed Revegetated. All timber, pole stage and older, covered by sediment will become Muflow Forest (See Table 2).

In Target Year 10

All cover types not covered by sediment will be same HSI and acreage as TY 5. One-half of Barren sediment area will be reseeded and placed in Disturbed Revegetated. All timber, pole stage and older, covered by sediment, will become Mudflow Forest.

In Target Year 25

1. All Urban area will be abandoned, though will remain in this category.

2. Grassland/Pasture will be in Forest Other Category (BL Forest #1 - HSI Value).

3. Reproduction Forest will be in Pole Stage. HSI will equal Pole Stage at baseline. Acreage will remain at Reproduction Forest for baseline.

4. Pole Forest will be reaching maturity, HSI will be Mean HSI for Mature Forest at baseline.

5. Barren areas remain as baseline Mean HSI for Barren cover type. One-half of Barren area will be seeded and moved into Disturbed Revegetated category.

6. Disturbed Revegetated will remain as baseline Mean HSI for Disturbed Revegetated; area will increase at the rate Barren areas are reduced.

7. All timber, pole stage and older, covered by sediment will become Mudflow Forest (See Table 2).

TABLE 3

Green River Site
(Elevation 965 with 7500 Acres)

Acreages (Covered by Sediment)

Class	1 yr.	5 yrs.	10 yrs.	25 yrs.	50 yrs.
Mature Forest	34	54	54	131	226
Reproduction Forest	189	294	294	772	836
Disturbed Revegetated	54	132	132	634	774
Riparian Forest	43	46	46	88	102
Pole Forest	17	53	53	176	221
Barren	241	268	268	939	908
Other Forest		15	15	100	119
Grass				41	58
Developed				5	23
TOTALS	578	862	862	2,886	3,267

In Target Year 50

1. Grassland will be Forest Other Category, Mean HSI at baseline.

2. Reproduction Forest will now be Mature Timber with Mature baseline HSI, acreage will be same, minus sediment coverage.

3. Pole Forest will be at maturity, HSI will be Mature at baseline, acreage same minus sediment coverage.

4. Barren areas remain as baseline Mean HSI for Barren cover type. One-half of Barren area will be seeded and moved into Disturbed Revegetated category.

5. Disturbed Revegetated will remain as Disturbed Revegetated; area will increase at rate Barren reduced.

6. Mature timber acreage equals baseline minus sediment coverage, HSI same as baseline.

7. All timber (pole and older) covered by sediment will become Mudflow Forest (See Table 2).

ASSUMPTIONS

In Formulating Project With - Elevation 960 with 7500 Acres

Timber Harvest Schedule

1. No timber harvest will occur, land will be purchased as is by the Federal Government.

2. No subsequent timber harvest will occur.

Natural Succession

1. In riparian areas, unstable masses, high erosion, limited seed invasion will hinder vegetation reestablishment.

2. Estimate 10 years for trees to reestablish; 100 - 150 years to mature forest. Alder, maybe Cottonwoods will be early tree species. Lupine, Devils Club are also early species (on cool mudflows). Huckleberry, Vine Maple are expected to be later plant species.

3. On hot mudflows primary succession will occur; Lupine, Fire Weed are expected to be early species. Some areas will remain barren for as long as 50 years.

Sediment Projections

At Green River:

1. Fiscal Year 85 cofferdam construction begins - 30 ft. high.

2. Will use 965 ft. pool elevation - 3,267 acres will be covered by sediment, 7,448 acres will be purchased by Federal Government at the retention structure to maintain sediment.

3. During low flow period (summer), the area will be like a dry lake with river flowing through - very similar to N - 1's condition.

4. During high flows (winter) - at dam, some pooling will occur.

5. Larger particles will fall out upstream.

6. Can expect changing braiding channels and flooding.

7. Should expect that this area will look much the same with and without project. Big differences will be in downstream channel braiding. Braiding will be reduced with the project. These differences will be reflected in LT-3 and LT-1.

8. Animals can probably walk on this area.

9. Artificial grass seeding and fertilization will occur throughout the life of the project.

At LT-1 and LT-3:

1. Sediment disposal at LT-1 and LT-3 will be an interim measure until the SRS is fully operational. LT-1 has almost reached capacity, filling will be completed here before filling is complete at LT-3.

2. Disposal material will completely cover the area in Target Year 1. Economically, this is the cheapest method for filling.

3. Artificial grass seeding and fertilization will occur throughout the disposal of sediment.

4. Disposal will be made in a way to create low areas for wetland development.

5. Tree seedlings will be planted when disposal is completed.

PROJECT WITH CONDITIONS

965 Elevation at Green River
LT-1

In Target Year 1

Entire area will be covered with dredge disposal; entire area will be barren. HSI will be Mean HSI for Barren.

In Target Year 5

Entire area will be covered with dredge disposal material. Grass will be established on one-half of the area by artificial seeding and fertilization. HSI will equal Disturbed Revegetated at baseline and Mean HSI for Barren at baseline.

In Target Year 10

Dredge disposal in the area will have been completed. Grass will be established on one-half of the area by artificial seeding and fertilization. Tree seedlings (Alder, Cottonwood, etc.) will be established on one-quarter of the area. HSI for three-quarters of the area will equal baseline. HSI for Disturbed Revegetated. Barren area HSI will equal Mean HSI for Barren at baseline.

In Target Year 25

Same as Target Year 10.

In Target Year 50

1. Grassland will cover one-quarter of the area; HSI will equal Mean Value at baseline.

2. Disturbed Revegetated will comprise one-quarter of the total area; HSI baseline Mean Value.

3. Other Forest will cover one-quarter of the area; HSI will equal Mean HSI Value at baseline.

4. Forested Wetland will comprise one-quarter of the area; HSI will equal Mean HSI Value at baseline.

PROJECT WITH CONDITIONS

965 Elevation at Green River
LT-3

In Target Year 1

Entire area will be barren. HSI values will be Mean HSI for Barren.

In Target Year 5

One-half of the area will be barren; one-half of the area will be reseeded. HSI values will equal baseline HSI values for Barren and Disturbed Revegetated.

In Target Year 10

Same as Target Year 5.

In Target Year 25

Dredge disposal in area will have been completed. Grass will be established on one-half of the area by artificial seeding and fertilization. Tree seedlings (Alder, Cottonwood, etc.) will be established on one-quarter of the area. HSI for three-quarters of the area will equal baseline HSI for Disturbed Revegetated. Barren area HSI will equal Mean HSI for Barren at baseline.

In Target Year 50

Same as LT-1.

COVER TYPES

Reproduction Forest

Managed timber under 20 feet in height.

Mature Forest

Timber greater than 60 feet in height, managed or unmanaged.

Disturbed Revegetated

Areas impacted by mudflow which are revegetating by sprouting or seeding (natural and artificial).

Barren

Minimal vegetation or completely lacking vegetation.

Pole Forest

Managed forest 20-60 feet in height, limited understory.

Riparian Forest

Arbitrarily delineated as 150 feet either side of Toutle River tributaries.

Other Forest

Broadleaf or mixed forest.

Developed

All developments including residential, logging, etc.

Forested Swamp

Palustrine, forested wetland.

Mudflow Forest

Areas affected by mudflow, timber is still standing, but dead. Understory is herbaceous or low shrubs.

STUDY NAME--MOUNT ST. HELENS

Without (PA 1) 965 El. Without 7540
With (PA 2) El. 965 With 7450 AC
Life of Project--50 Years

November 13, 1984

Evaluation Species	AAHU With	AAHU Without	AAHU Change
1. Red-tailed hawk	1,796.41	1,795.26	1.15
2. Violet green swallow	3,547.90	2,657.34	890.56
3. Common snipe	1,107.12	685.78	421.34
4. Gold-crown kinglet	2,386.34	2,377.00	9.34
5. Mallard	1,107.13	840.77	266.36
6. Ruffed grouse	2,691.14	2,681.50	9.65
7. Song sparrow	2,694.61	2,333.79	360.81
8. Bobcat	2,960.08	3,575.33	-615.23
9. Shorttail weasel	2,063.04	2,457.63	-394.59
10. Black-tailed deer	3,229.34	2,994.95	234.40
11. Roosevelt elk	2,788.49	2,961.72	-173.22
12. Beaver	1,447.28	890.04	557.23
13. Townsend chipmunk	2,341.26	2,869.52	-528.25
14. Pacific giant salama	1,309.51	1,482.90	-173.38

APPENDIX C. Estimated Costs for Specific Mitigation Measures

Instream Rehabilitation

Gabions	$18/linear foot
Modification of log jams	$4,000 - $10,000
Log sills	$180/sill
Boulder groupings	$300 - $600/group or $16/linear foot
Blasting (creating) pools	$350 - $500/pool
Modification of culverts	$2,400
O&M	$1,000/year beginning at 5th year
Gravel replacement	$30,000 - $41,600/stream
Root wad replacement	$800 - $1,500/day

Passage

Trap and haul	$1,000,000
O&M	$100,000/year
Juvenile bypass	Built into dam

Public Access

$60,000 - $70,000/site - does not include land costs

Fish Stocking

Upstream of Green River SRS	$1,400 - $1,700 annually

Revegetation

Douglas Fir	$125/1,000 seedlings
Alder	140/1,000 seedlings
Willow - Cottonwood	125/1,000 seedlings

APPENDIX D. Listed and Proposed Endangered and Threatened Species and Candidate Species that may Occur within the Area of the Cowlitz and Toutle Rivers, Cowlitz and Lewis Counties, Washington Updated 11/15/84 (1-3-85-SP-58) Cross Reference (1-3-83-SP-85).

LISTED

Bald Eagle (*Haliaeetus leucocephalus*)

Cowlitz County

Nesting territory - T07N, R01W, Sec. 31 - 1/4 mile south of Coweeman River - nest down in 1980.

Lewis County

Nesting territory - T11N, R01E, Sec. 7-8. 11/6/81
Nesting territory - T12N, R01E, Sec. 27 - inactive.
Nesting territory - T11N, R04E, Sec. 2 - inactive; inundated by Riffe Lake.
Nesting territory - T12N, R03E, Sec. 26 - inactive; two nests - nests down in 1979.
Nesting territory - T11N, R06E, Sec. 06 - inactive; two nests - nests down in 1982.
Nesting territory - T12N, R08E, Sec. 10 - inactive; nest down in 1982.
Nesting territory - T12N, R09E, Sec. 06 - inactive; nest down in 1982.
Nesting territory - T13N, R09E, Sec. 16 - inactive; nest down; area clearcut in 1981.
Nesting territory - T12N, R21E, Sec. 16 - 1 young produced - 1982.
Nesting territory - T11N, R06E, Sec. 07 - status unknown.

Wintering concentrations of eagles occur along both the Toutle and Cowlitz Rivers with highest concentrations around and below Mayfield and Riffe Lakes.

PROPOSED

None.

CANDIDATE

None

EXHIBIT 2

PUBLIC VIEWS AND RESPONSES

EXHIBIT 2

PUBLIC VIEWS AND RESPONSES

This exhibit contains copies of all comments received on the Draft Feasibility Report and EIS during the 45-day public review period which ended 17 December 1984, and the Corps responses to those comments. This includes written comments received as a result of the public meeting which was held in Longview, Washington on 29 November 1984. A list of the agencies, organizations and individuals who provided comments is included in this exhibit.

Comments and Corps responses are presented in two sections: 1) Letters with detailed comments which require specific, individual responses, and 2) Letters with general comments which are common to a number of other respondents. Responses to comments in the first group of letters are provided with each letter; the second group of comments is responded to in summary format in the following paragraphs. In this summary, similar comments from different sources are consolidated into a single paraphrased comment. These comments generally express support for the preferred plan, opposition to local cost-sharing, or opposition to the preferred plan. The Corps response immediately follows each comment.

SUMMARIZED COMMENTS AND RESPONSES:

1. Comment: We wish to express our support for implementation of the preferred plan consisting of a sediment retention structure on the North Fork Toutle River at the Green River site along with downstream measures to remove sediment from the Lower Toutle, Cowlitz, and Columbia Rivers.

Response: Thank you for expressing your views on this plan. Your views will be considered in reaching a final decision on a sediment control solution for Mount St. Helens.

2. Comment: We object to the proposal that local and state governments share in the cost of construction of this project.

Response: Thank you for expressing your views on this plan. Your views will be included in the official record which will be provided to Administration officials for their consideration in developing their recommendations to Congress for project authorization and funding.

3. Comment: We are opposed to construction of a sediment retention structure on the Toutle River. Please consider other alternatives to achieve sediment control.

Response: We have considered many sediment control alternatives, including alternative measures and alternative locations for their implementation. We have outlined the process of identifying and screening these alternatives in the Feasibility Report. It is our conclusion based upon existing information that the preferred plan consisting of a sediment retention structure on the North Fork Toutle River combined with downstream measures is the most efficient and cost effective solution to the sediment control problem. However, we are continuing to monitor sediment erosion and if a significant change occurs, we will re-evaluate the preferred plan. We thank you for expressing your views. Your views will be included in the official record which will be provided to Administration officials for their consideration in developing their recommendations to Congress for project authorization and funding.

Comments on the Draft Feasibility Report and EIS were received from:

U.S. Environmental Protection Agency
U.S. Department of Interior
U.S. Department of Commerce - National Marine Fisheries Service
U.S. Department of Health and Human Services
U.S. Department of Transportation - Federal Highway Administration
Washington Governor John Spellman
State of Washington Department of Fisheries
State of Washington Office of Archaeology and Historic Preservation
State of Washington Department of Game
State of Washington Department of Social and Health Services
Cowlitz County
Cowlitz - Wahkiakum Governmental Conference
City of Castle Rock
City of Longview
City of Vancouver
Local Government Consensus (43 Entities)
Port of Kalama
Port of Longview
Port of Vancouver
Port of Walla Walla
Longview Public Schools
Beacon Hill Sewer District
Consolidated Diking Improvement District No. 1
Cowlitz Economic Development Council
Longview Chamber of Commerce
Willapa Hills Audubon Society
Longview Fiber Company
Weyerhaeuser Company
Quoidbach Construction Company
Richard and Joan O'Neill
Muriel Gulickson
Doris & David Deschacht
Ralph & Ferne Uining
Arnold Olson
Harvey & Betty Anne Cliffton
O. G. Woolridge
Penelope Harvey
Stephen Wargo
Mr. & Mrs. A. W. Mott
Gordon Kerr
Elaine Bradford
Mr. & Mrs. L. S. Peru
Mr. & Mrs. Dale Kodad
Jack Harper
Sally Harper
Marshall Black
Harry Larsen
Elaine Larsen
Glen Milhise
Phil Hill
Benny Hill
C. R. Ruff

Hank Suny
Kathy Hammer
Larry Ruis
James Nunn
John Shaw
Donald Binion
Joseph Gallon
Terry Herndon
Brian Greenwood
Patrick Schmitt
Greg Drew
Albert Wiest
William Weiss
Alden Jones
Roy Hollister
Peter Meyer
Gail Todd
Mabel Stewart
Lois Hartwell
Shirley Dalsgard
C. A. Rolfe
Grace A. Rolfe
Janet Hicks
M. Studeman
Roland & Morita Lyons
Margaret Gudgel
Mrs. E. H. Peterson
Mr. & Mrs. W. A. Kemper
Mrs. A. J. Larsen
J. Koplis
Elba Saffel
Robert & Selma Bricknell
Frank & Hope Taylor
Mabel Kent
Daisy Turner
Mr. & Mrs. C. E. Whittle
Mary Pease
Joe & Martha Merly
Irene Hart
Hariett McDaniel
Dorothy Franck
Mr. & Mrs. Jeffery L. Davis
Teresa Bombardier
John & Hazel Ericksen
Nancy & Sam Boyd
Jim & Kathy Mauck
Jim Fletcher
W. K. Lacey
Frank Swideroki
Mrs. Helen Maier
Carl H. Dunning
Robert & Erma Fristad
Mrs. Genevieve Mayo
Mr. & Mrs. Burl Gilpin
Paula & Bob Bartell
William & Esther King
Donna Rolfe
Stanley G. Hooper
Malcolm Worrell
Robert N. Vaught
Mary R. Springer
Mr. & Mrs. R. A. Ainslie
Beverly Bright
Bert Lake
Don Manasio
Patricia Nicholson
Mrs. Lillian Bundy
W. G. Presnell
Zoltan Kosa
Michael & Joyce Coffey
Karl O. Jonasson
Alan W. Goofrey
Mr. & Mrs. Leo Walstead
Carolyn Shelton
Lee Culkins
Ray Ryan Bernice L. Mackey
Linine F. Randolph
Frank J. Saryz
Michele V. Bogdon
Robin Schwalm
Douglas G. Noakes

Section 1: Comments with Specific Responses

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION X
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

REPLY TO ATTN OF: MS 423

DEC 13 1984

Colonel Robert L. Friedenwald
District Engineer
Portland District Corps of Engineers
P. O. Box 2946
Portland, Oregon 97208

RE: Mount St. Helens, Washington: Feasibility Report and Draft Environmental Impact Statement

Dear Colonel Friedenwald:

We have reviewed the referenced document concerning a long-term solution to the sedimentation and flooding problems caused by erosion of the debris avalanche near Mount St. Helens, Washington. We offer the attached comments to assist you in preparing the final Environmental Impact Statement (EIS).

Our review indicates there are two important unresolved mitigation issues associated with construction of the preferred alternative (the Single Retention Structure at the Green River site on the North Fork Toutle River). These are: (1) provision for adequate anadromous fish passage facilities at the proposed dam, and (2) avoidance of, or mitigation for, the use of wetlands near the mouth of the Cowlitz River for the deposition of dredged sediments.

We support the inclusion of a fish passage component as a part of the preferred alternative. Due to the uncertainty of establishing a successful anadromous fish passage program, we recommend alternative mitigation measures be incorporated into the project to assure restoration of this important resource. Such measures might include a commitment to restore fish runs and/or habitat in other areas within the Toutle/Cowlitz River drainages.

We were disappointed by the lack of discussion of alternative strategies for dredged material disposal at the mouth of the Cowlitz River. This activity is a part of this project and should be included in the EIS. We fully support the recommendations of the U.S. Fish and Wildlife Service (final draft Coordination Act Report, December, 1984) relative to this issue. Based upon that report and the evidence presented by the Corps in Appendix D, it appears to be possible to avoid impacting wetlands and high value riparian habitats adjacent to the Cowlitz and Columbia Rivers. For those areas that are impacted, mitigation must be provided. We recommend the Corps, EPA and appropriate resource agencies convene a task force immediately to prioritize disposal sites and establish mitigation requirements. Funding for this mitigation, as with all mitigation efforts associated with this project, should be made a part of the project cost (i.e., they should be funded by Congress and implemented by the Corps).

The selection of an appropriate strategy for handling the sedimentation problem depends primarily on estimates of debris avalanche erosion rates. Appendix C contains information which indicates there is a great uncertainty associated with making such estimates. We support the Corps commitment to use continually updated sediment erosion data in making decisions on alternatives. If future data demonstrate a lower than expected rate of sedimentation, consideration must be given to effective alternative strategies which are less costly (e.g., the use of Sediment Stabilization Basins or the construction of a lower Single Retention Structure).

According to our rating system for EISs, we have rated this document EC-2, which means that EPA has environmental concerns with the implementation of the preferred alternative and we feel the EIS contains insufficient information to fully assess environmental impacts that should be avoided in order to fully protect the environment.

If you have any questions concerning our comments, please contact Mr. Gary Voerman of my staff at FTS 399-1448.

Sincerely,

Ernesta B. Barnes
Regional Administrator

Attachment

cc: USFWS-Portland
USFWS-Olympia
NMFS
WDE
WDG
WDF

Detailed Comments

1

(1) The environmental issue of primary concern to EPA is the impacts associated with the use of wetland areas near the mouth of the Cowlitz for the deposition of dredged material. Part of the difficulty in addressing this issue stems from the multitude of documents identifying potential disposal sites and estimating dredged material volumes. For purposes of this analysis we have used the Fish and Wildlife Coordination Act Report (final draft, December, 1984), the Cowlitz-Toutle Watershed Management Plan (1983), and Appendix D, Exhibit 5 (Analysis of Potential Dredge Disposal Sites). This illustrates the need for a definitive comprehensive evaluation of disposal site options. This would be one task of the proposed dredged disposal task force to be formed in the near future.

From information in the referenced documents it appears feasible for the Corps to follow the U.S. Fish and Wildlife Service Coordination Act Report recommendations concerning disposal sites. For the preferred alternative (177 foot-high Sediment Retention Structure-Green River Site). Sediment from the Cowlitz River sumps can all be placed in areas identified as not requiring mitigation. By our calculations, such areas have much more than the fifteen million cubic yard (mcy) capacity required over the life of the project. In fact, according to the maps provided in Appendix D, Exhibit 5, Cottonwood Island alone could accomodate the 71 mcy of sediment projected for the no action alternative. Basically, we see no reason to use valuable wetland areas for the disposal of Mount St. Helens sediments.

A full and accurate analysis of dredged material disposal options should be included in the EIS. Such an analysis must encompass other disposal areas, such as those identified on pages 39-41 of the Fish and Wildlife Coordination Act Report. There is no justification provided by the Corps for limiting consideration of disposal sites to those two miles or less from the Cowlitz sump. Additionally, the capacity of all sites would be increased substantially if the fill reaches 70 feet CRD as proposed. In-water (maintenance channel) disposal of dredged material must also be evaluated as an option which minimizes adverse impacts to wetland habitats.

2

(2) EPA supports all of the recommendations contained in the December 1984, U.S. Fish and Wildlife Coordination Act Report prepared for this project.

3

(3) While the EIS (pg IX-I) incorporates all attachments by general reference, the usefulness of this document to decisionmakers would be enhanced substantially if specific pages were referenced and if important data and conclusions were summarized. The Fish and Wildlife Coordination Act Report and Appendix D both contain information which should be summarized or specifically referenced in the text of the EIS.

4

(4) The details and problems associated with the fish passage mitigation plan should be more thoroughly discussed in the EIS. Such a discussion is found on pages D-121-123. If the problems associated with trapping and hauling adults and passing fingerlings through the regulated outlet structure cannot be overcome, what alternative mitigation measures will the Corps be committed to implement?

5

(5) Pg. IX-4; the EIS should document what further studies were conducted to justify the statement that several fish and wildlife mitigation measures were "neither justifiable or appropriate for inclusion with this project."

6

(6) We agree with the statement concerning the need for additional environmental assessment of impacts associated with dredging and disposal activities (pg. IX-II). Where feasible, such assessments should be made a part of the EIS. If these assessments indicate wetland impacts, we will require mitigation consistent with NEPA and the 404(b)(1) Guidelines.

7

(7) The "Comparative Effects of Alternative Plans" chart (pg. IX-13-20) should contain more specific information to allow a reasoned judgement on comparative impacts. Specifically, a quantification of impacts associated with each of the alternatives would be useful. Generalized statements concerning sedimentation and fish and wildlife benefits are not useful for meaningful alternatives comparisons. The information necessary for this modification is contained in the various attachments to the EIS.

8

(8) In light of the above discussions on dredged material disposal sites, the basis for the statement (pg. IX-26) that limited area for disposal "will soon result in filling valuable wildlife habitat" should be articulated in the EIS. We believe valuable wildlife habitat can be avoided by careful planning.

9

(9) Previous planning efforts have resulted in the selection and use of several specific sites for dredged material disposal (pg. IX-33). These sites that have been and are being used should be identified in the EIS along with those sites proposed for use. The environmental impacts associated with a variety of disposal alternatives should also be evaluated in the EIS.

10

(10) The amount of dredged material removed by the Sediment Stabilization Basin alternative should be included in the EIS (pg. IX-34). In conjunction with this alternative, the amount of dredging required in the Cowlitz and Columbia Rivers should be calculated along with the acres and types of habitats expected to be impacted.

11 (11) The water quality impacts of all alternatives are not discussed in sufficient detail for a comparison to be made (pg. IX-31-36). In addition, the information on adverse water quality impacts associated with the Stilling Basins (pg D-20-21) should be included in the EIS. What impacts will algae blooms, bacteria and potential dissolved oxygen depletions in the Stilling Basin have on fisheries and public health?

12 (12) The basis for the statement that erosion of mudflow deposits would continue below the sediment retention structure for only two years should be explained in the EIS. This statement seems inconsistent with the contention that sediments will accumulate in the Cowlitz and Columbia in substantial quantities up to five years after project initiation.

13 (13) The statement (pg. IX-38-39) that lack of environmentally sound disposal sites will require the use of upland sites providing "valuable detrital imput" and inwater sites in locations that provide "valuable fish rearing areas" ignores Corps plans to fill valuable wetland areas (which have values for detrital imput as well as for fish and wildlife). Locations, acreages and values of these sites should be included in the EIS.

14 (14) pg. IX-40: How would fisheries be affected in the Sediment Stabilization Basin alternative compared to the Base Condition? How much reduced sedimentation would occur in the Cowlitz and Columbia as a result of implementation of the SSB alternative?

15 (15) The discussion of water quality (pg. IX-42-43) should include the information provided in D-20-21.

16 (16) Pg. IX-43; Please identify the "productive rearing habitat" that must be filled in the Columbia River under the No Action alternative.

17 (17) The statement (pg. IX-44) on the lack of environmentally acceptable disposal sites and the loss of hundreds of acres of valuable wildlife habitat at the mouth of the Cowlitz under the No Action alternative should be supported. As stated above; we feel that insufficient information exists to make such a statement and that the Corps site capacity figures in Appendix D contradict this contention. We do recognize that the preferred alternative would substantially reduce the need for Cowlitz Sump dredging and would have the environmental benefit of reduced impacts on all downstream habitats. The exact nature of that benefit has not yet been determined.

18 (18) Pg. IX-46; The types and acres of habitat impacted under the Base Condition should be summarized in the EIS (note habitat maps in the Fish and Wildlife Service Coordination Act Report). How much reduced sediment load to the Columbia River will result from this alternative.

19 (19) How does limited Permanent Evacuation differ from the Base Condition such that it results in different wildlife impacts? It would be best to summarize all adverse environmental impacts for each alternative The summary should highlight those impacts associated only with the alternative under discussion to avoid the misleading suggestion that one alternative has unique impacts that are, in fact, held in common with other alternatives.

20 (20) Pg. IX-47; How much sediment reduction in the Columbia River will result from the implementation of the Sediment Stabilization Basin Alternative?

21 (21) Pg. IX-48; How much reduction in Columbia River sedimentatin would result from the implementation of the Multiple Retention Structure Alternative? What acreages and types of habitat behind the structures would be affected by this alternative?

22 (22) Pg IX-48; How many acres of wetlands/riparian habitat will be created behind the single retention structure over the project lifetime?

23 (23) Pg IX-66: Appropriate steps to minimize potential adverse effects on the aquatic ecosystem include efforts to avoid or mitigate for downstream impacts associated with dredging. In addition to the fish passage mitigation commitment, we recommend the Corps agree to avoid wetland habitats where feasible and mitigate for any such habitats adversely impacted by dredged material disposal.

24 (24) We support the statement (pg. X-5) concerning the use of updated sediment data in CP&E studies. If significant reduction on sediment estimates result from new data, other alternatives may become preferable from both an economic and environmental standpoint.

Responses to EPA Comments:

1. Dredging at the mouth of the Cowlitz River would prevent sediment from entering the Columbia River navigation channel, and is therefore a maintenance activity associated with that channel project. While Columbia River dredging is discussed in this feasibility report to provide a comprehensive evaluation of impacts, no specific authorization or funding is requested in this report for actions necessary to maintain this navigable waterway nor is dredging and dredged material disposal at the mouth of the Cowlitz a part of the preferred plan addressed in this report. Authority is already provided under P.L. 87-874 for actions pertaining to federal maintenance of the Columbia River navigation channel. Evaluation of the effects of dredged material disposal associated with maintenance of this channel are separate from this report and would be accomplished under that authority. We support the proposal to form a task force, under this authority, to address disposal activities for this area.

2. Comment noted.

3. Comment noted. The referenced documents were used in preparing this Environmental Impact Statement.

4. Developing specific plans and specifications for fish passage facilities, as well as the main dam, will be accomplished during the Continued Planning and Engineering (CP&E) stage. If it is determined that the fish passage facilities are inadequate, studies would be initiated to develop and, if justified, to construct new improved fish passage facilities or other mitigative features.

5. U.S. Fish and Wildlife Service modified their recommendations in their final Coordination Act Report. Our responses to the recommendations of the final report may be found in Exhibit 1.

6. As stated in the EIS (P. IX-11), the information available at this time relating to the need for and the location of dredging and disposal is insufficient to clearly define the timing and extent of dredging and disposal activities. Columbia River dredging and disposal requirements will be addressed as part of normal navigation channel maintenance coordination.

7. As you note, the table of comparative effects summarizes the highly detailed information contained in other sections of the main report and appendixes. Expansion of this table to include this more detailed data would create an unwieldy assemblage of information. The table serves the purpose of demonstrating the relative impacts of the various alternatives so that the reader can better organize, in his or her own mind, the information contained throughout the report.

8. To the extent practicable, we hope to avoid impacting valuable wildlife habitat through careful planning. We have proposed establishing a task force to address dredged material disposal. The statement you have referenced, however, reflects the magnitude of material that may require disposal under our worst-case analysis.

9. Please refer to Responses 1 and 6.

10. This alternative was addressed in the Comprehensive Plan but screened from further detailed evaluation in the Feasibility Report. Please refer to page V-9 of the Comprehensive Plan for this detailed analysis.

11. Information on the water quality effects associated with the stilling basins has been added to the EIS. Other water quality effects of the preferred plan will continue to be evaluated during the CP&E stage.

12. The EIS has been revised to clarify this point. The statement on p. IX-36 of the Draft EIS that "erosion of mudflow deposits would continue for two years" has been changed to "dredging in the Lower Toutle River would continue to be required for two years."

13. Please refer to Response 1 and 6.

14. Please refer to Response 10.

15. This information has been added to the EIS.

16. The statement you have referenced reflects the magnitude of material that may require disposal under our worst-case analysis for the no-action alternative. Under the no-action alternative, emergency dredging may be required to maintain the navigation channel. Such emergency operations would require the use of the most expedient disposal sites, which could include productive rearing habitat.

17. The statement you have referenced has been clarified to read "The lack of environmentally acceptable disposal sites at the mouth of the Cowlitz to contain all material requiring dredging under this alternative will require the use of some areas of high wildlife value; wildlife losses associated with the loss of riparian and wetland habitats with this alternative could be significant." The volumes you have referenced in Appendix D were calculated to show maximum potential disposal, not probable, disposal. The volumes shown in Appendix D were calculated using heights of 70 feet and slopes of 1V on 4H.

18. The majority of the maps shown in the CAR were prepared by Portland District for the habitat-based evaluations conducted for this study. Since the CAR is an exhibit to the main report, and to reduce redundancy and length, they were not included in the EIS. The projected Columbia River dredging requirements for the no-action condition during the 50-year project life is 145 mcy. With the base condition, this requirement is reduced to 71 mcy (see Chapter II).

19. The Limited Permanent Evacuation alternative includes the removal of structures from the flood-prone areas upstream of the leveed areas of Kelso and Longview. Sediment would be allowed to accumulate in these areas and to naturally revegetate, eventually creating wildlife habitat where urban development had existed before. The base condition does not provide for the removal of structures and would not result in a similar creation of wildlife habitat.

20. Please refer to Response 10.

21. This alternative was addressed in the Comprehensive Plan but screened from further detailed evaluation in the Feasibility Report. Please refer to pages V-11 to V-14 of the Comprehensive Plan for this detailed analysis.

22. Once the maximum sediment retention has been accomplished, a broad plateau would remain behind the single retention structure. Riparian and wetland habitats would develop in this area through natural revegetation. The number of acres of each of these types of habitats would be difficult to estimate with certainty at this time.

23. Any effects on wetland habitats which might occur would result from dredging at the mouth of the Cowlitz, which would be done as part of the maintenance dredging for the Columbia River navigation channel. Assessment of the effects on wetlands, as well as any potential mitigation, would be accomplished under that authority.

24. Comment noted.

United States Department of the Interior

OFFICE OF THE SECRETARY

PACIFIC NORTHWEST REGION

500 N.E. Multnomah Street, Suite 1692, Portland, Oregon 97232

December 20, 1984

84/1393

Colonel R. L. Friedenwald
District Engineer, Portland District
U.S. Army Corps of Engineers
P. O. Box 2946 Portland, Oregon 97208

Dear Colonel Friedenwald:

The Department of the Interior has reviewed the Draft Feasibility Report and Environmental Impact Statement (EIS) for Mount St. Helens, Cowlitz County, Washington. The following comments are provided for your use and consideration when preparing the final document.

General Comments

The Department of the Interior believes that the draft EIS omits needed information and is deficient in several areas that are essential to a clear understanding of the environmental impacts that would occur as a result of implementing the preferred plan. In most instances, fish and wildlife impacts of the preferred plan are not clearly identified or quantified. In some cases, impacts are understated or absent from the discussion. Instead the draft EIS provides a general analysis of the relative impacts of the various alternatives addressed in the Corps of Engineers (Corps) November 1984 comprehensive plan for responding to the long-term threat created by the eruption of Mount St. Helens, Washington. Information on the preferred plan is no more detailed than that provided for any of the other alternatives, yet the draft EIS is accompanied by a draft
1 feasibility report that will be used to recommend Congressional authorization and funding for construction of a specific plan.

The Fish and Wildlife Service (FWS) has prepared a Fish and Wildlife Coordination Act Report (CAR) addressing the impacts of the project on fish and wildlife resources. The report identifies important mitigation measures to prevent or offset the impacts of the project on these resources. The draft CAR that accompanies the draft feasibility report addresses the full range of project alternatives and impacts, and the mitigation recommendations are accordingly broadranging in scope. Since then, the Corps has provided specific project information on the preferred plan to the FWS, Therefore, the final CAR will focus on the preferred plan's impacts and mitigation needs. The final CAR will become part of the final feasibility report.

The final EIS should incorporate details from the final CAR and be consistent with its findings and recommendations.

1 Finally, the draft EIS does not address the cumulative effects of the preferred plan's impacts to fish and wildlife resources, in conjunction with impacts from measures to control water levels in Spirit Lake. The impacts of the Corps' plan for a permanent outlet for Spirit Lake were addressed in an earlier EIS and separate CAR dated February 10, 1984. In its response to that report, the Corps stated that measures not appropriate for the short-term, emergency nature of the Spirit Lake work should be included in the feasibility study recommendations. A discussion of cumulative effects of Corps' activities in the Toutle River watershed and actions planned to address those effects should be provided in the final EIS.

Specific comments of the Fish and Wildlife Service
Draft Environmental Statement

2 Page IX-1, Abstract: Information, displays, and maps referred to in the main report and appendices incorporated by "reference" into the draft EIS, are notably lacking as reference material in the draft EIS.

3 Page IV-4, Unresolved Issues: It is stated that "further study" determined that several of the measures recommended by the FWS in the draft CAR were neither justifiable nor appropriate for inclusion with the project, yet no reference to the study or its findings is provided. The FWS has incorporated a number of changes into its final CAR to address the specific impacts of the preferred plan. The draft CAR had recommended mitigation actions needed to address the impacts of the full range of project alternatives. The final CAR concludes that necessary mitigation actions would be significantly reduced, though not eliminated, by selection of the preferred plan. To the extent the Corps' EIS is compatible with the findings of the final CAR, there should be no unresolved issues.

4 Page IX-6, Alternatives: The abstract and summary sections identify a "preferred alternative" at the Green River site, including "associated actions", yet the draft EIS provides no further discussion or analysis of a preferred plan. The general relative analysis of alternative SRS locations and sizes, in comparison with other alternatives, does not provide the reader with a specific understanding of the preferred plan features or impacts.

5 Page IX-16, Comparative Effects: It is unlikely there would be a reduction in turbidity with the SRS because they are designed only to retain coarser materials. The fine materials (clays and silts) are easily eroded and transported and would remain in suspension (see page IX-22).

6 Page IX-36, SRS: There is no reference or documentation supporting the "greatly increased rate" of physical and biological recovery of the lower river that is assumed to occur compared to the no action conditions. What supporting information is available in the feasibility report or Appendices? In addressing downstream erosion rates below SRS (Appendix "D", Page D-37), it is stated that downstream degradation was assumed to be equal to the Toutle River erosion under the no action conditions. This statement and the assumption of "greatly increased rate" of recovery seem to be contradictory.

7 Page IX-49, Columbia: There is no reference or documentation supporting the assumed benefits of reducing wildlife impacts to the Columbia. It is stated that disposal would be limited to 15 mcy but there is no detailed disposal plan nor any quantification of disposal impacts on wildlife habitat. These items should be discussed in detail.

8 Page IX-60, Section 404(b) Evaluation: The need to dredge and dispose of 15 mcy of material in the Columbia with the SRS alternatives is stated throughout the feasibility report and draft EIS (see above comment). However, there is no discussion at all of fish and wildlife impacts associated with dredging and dredge spoil disposal in either the draft EIS or the Section 404(b) evaluation. Dredging and disposal of material in the Cowlitz and Columbia Rivers to maintain the navigation channel and to provide interim flood protection as authorized by Public Law 98-63, has had significant adverse impacts on wetland resources. On several occasions the FWS has recommended to the Corps that plans be developed and implemented to mitigate for these impacts but no action has yet been taken. The disposal of 15 mcy in this area with the preferred plan has the same potential to have serious wetland impacts. The apparent disregard of these impacts in both the draft EIS and Section 404(b) evaluation is not compatible with either the spirit or the intent of the Clean Water Act and is of grave concern to the FWS.

DRAFT FEASIBILITY REPORT

General Comments

9 The FWS does not agree with the frequent reference in the report that imply that fish and wildlife issues are addressed fully in the draft EIS. Information regarding project impacts and recommended mitigation actions has been provided to the Corps by the FWS in a revised Fish and Wildlife CAR. Information contained in that report should be incorporated in the EIS and the final feasibility report to ensure that fish and wildlife issues are fully addressed and incorporated in project plans.

Specific Comments

10 Page VII-4: The draft feasibility report indicates that project sponsors should pay the cost of most mitigation measures. While it may be appropriate for local sponsors to share the cost of project mitigation, the Corps must recognize that it is their full responsibility to ensure that project construction and mitigation are accomplished in accordance with Federal environmental policy and legislation. This requires the recognition of project impacts, reducing impacts through selection of least damaging alternatives where possible, mitigating for remaining impacts, and monitoring of project and mitigation actions to ensure they function as planned.

Appendix D, Exhibit 5: This exhibit in the feasibility report contains an analysis of potential dredge disposal sites in the Cowlitz and Columbia Rivers. Unfortunately, the criteria used to select these sites do not include any environmental considerations. Disposal material dredged from the Cowlitz sump and the general vicinity of the confluence of the

Cowlitz and Columbia Rivers has been of great concern to State and Federal resource agencies. The agencies have been eager to work with the Corps in designation of sites and developing mitigation measures where required. The feasibility report presented an excellent opportunity to discuss both short- and long-term disposal plans. In view of the above, we suggest the final report include environmental impacts as a criteria for potential site selection.

Exhibit 1, Fish and Wildlife Coordination: This section contains the Corps' responses to recommendations made in the FWS's draft CAR. A number of recommendations have been deleted or changed significantly so the responses are no longer appropriate. In addition, a number of issues have been resolved or modified to a satisfactory degree. Comments on the remaining responses are as follows:

General Response: This response includes a statement that FWS recommendations do not clearly identify whether the action provides mitigation or enhancement. Actually, all of the recommendations in the draft CAR would provide mitigation only.

10 Response 3, Page 3: It is acknowledged that the recommendation was very broad, but this was necessary because of the numerous alternatives considered in the early feasibility study phase. Monitoring studies recommended in the final CAR apply directly to project-related mitigation aspects.

Response 5, Page 3: The FWS does not agree that bypass at Green River SRS is the primary mitigation need since stream habitat improvement, wetland protection, revegetation, etc. would also be necessary to mitigate for project impacts. The final feasibility report should address all of the major mitigation recommendations and provide for modification if warranted.

Response 7 through 12, Pages 3 and 4: We believe it is the Corps' responsibility to ensure that mitigation is planned and implemented prior to or concurrently with project construction. Further, funding of these actions should be a project responsibility.

Specific Recommendations - Toutle

Response 1, Page 5: The FWS does not concur with the Corps' decision that the State be responsible for all costs associated with operation and maintenance of mitigation features. Mitigation should be considered a project expense and funded accordingly.

Response 4, Page 6: The recommendation for a fish hatchery has been withdrawn and the Corps has agreed to the development of rearing ponds.

Response 5 and 6, Pages 6 and 7: The FWS does not concur with the Corps' conclusions that these recommendations would provide enhancement. As stated elsewhere, the FWS has not recommended any enhancement actions.

Response 7, Page 7: The plan referred to in Recommendation 7 is to coordinate mitigation actions associated with the SRS only, not a basin-wide plan.

Response 10, Page 9: The measures referred to are mitigation only. No enhancement would result if actions are implemented.

FWS Summary Comments

1 As indicated in the foregoing comments, the FWS believes there are several areas that should be more fully addressed in the final EIS. In particular, more emphasis should be placed on specifying and quantifying impacts to fish and wildlife resources that would occur with the preferred plan. The need for adequate mitigation as provided in the final CAR should be discussed and incorporated into the final EIS. The final EIS should also address cumulative impacts of the Corps actions in the watershed, and the impacts to and mitigation needs for wetland habitats affected by disposal of dredged material.

For further assistance in these fish and wildlife matters, please contact:

Field Supervisor
U.S. Fish and Wildlife Service
727 N.E. 24th Avenue
Portland, Oregon 97232
Phone: (503) 231-6179
FTS 429-6179

Specific Concerns of the Geological Survey

The Corps' Mount St. Helens, Washington, Feasibility Report assembles an impressive body of information on the complex long-term sediment management problems posed by Mount St. Helens. The Corps has recommended a solution compatible with our present state of knowledge and flexible enough to respond to the results of continuing scientific investigation. We agree with the assessment that under normal hydrologic conditions the sediment management problems associated with the Toutle and Cowlitz Rivers are less acute but more persistent than the initial assessments presented in the Toutle-Cowlitz Watershed Management Plan and the Corps' original comprehensive plan for responding to the long-term threat created by the eruption of Mount St. Helens, Washington. We are particularly pleased to see increased attention focused on the potential sediment volume associated with individual mudflow and extreme flood events. The occurrence of such events could well cause problems during the construction phase of the proposed sediment retention structure.

12 The Corps should caution the public that certain phenomena critical to the long-term sediment management strategy are still incompletely understood by scientists monitoring the volcano. These phenomena are: (1) future eruptive activity of Mount St. Helens; (2) transport of poorly sorted, course-grained sediment in steep channels; and (3) generation of mud and debris flows by volcanic and nonvolcanic processes.

Uncertainties about the number, type, and magnitude of future eruptions will persist for the long term, but the research and monitoring now in progress at Mount St. Helens should improve the U.S. Geological Survey's (USGS) predictive capabilities in a time frame which will allow for short-term operational decisions.

The lingering uncertainties about sediment transport and mud and debris flow generation are the subjects of intensive investigations by the USGS at Mount St. Helens and by many scientific and engineering colleagues working in the Pacific Rim Steeplands. Breakthroughs that will permit more realistic simulation of erosion of the North Fork Toutle debris avalanche and downstream sediment transport are likely over the next several years. Until that time, some divergent opinions will likely persist concerning precise erosion problems, sediment sorting and armoring processes, rates of sediment transport, and downstream channel adjustments.

These comments are not meant to imply that action should be withheld pending research results. Major sedimentation-induced flood hazards exist now and will only worsen if not addressed promptly. We only wish to emphasize the desirability of maintaining flexibility to allow for an appropriate response to future increases in scientific knowledge.

13 We believe that the feasibility report may not give appropriate consideration to future channel incision on the North Fork Toutle debris avalanche deposit and downstream transport of the larger-than-2 mm-size fraction. As a result, we believe that sediment volumes in the Corps' 1985-2035 sediment budget are conservative. The Corps' computations appear to reflect an extrapolation of erosion rates observed over the last years--a period without any major regional storms.

The feasibility report assumes that the three large avalanche-impounded lakes are stable (p. IV-27, par. 2) and that a breaching-induced mudflow is not possible. Breaching scenarios other than overtopping are possible, however. Erosion over the 50-year project life could adversely affect the stability of these lakes. For example, mass failure could occur during a seismic event superposed upon seasonally high water tables in the blockages. Periodic assessment of the lake impoundment stability is clearly warranted.

A recently completed investigation of pre-1980 volcanic mudflow deposits along the Toutle River suggests that the frequency of mudflows large enough to inundate the flood plain at the confluence of the North and South Forks of the Toutle River may have occurred more frequently than indicated in published reports. At least 30 such flows have occurred over the last 4,500 years. These flows tend to be clustered during eruptive periods similar to the present activity at Mount St. Helens.

The feasibility report emphasizes the gradual degassing of the dacite magma feeding the dome, and implies a declining probability of explosively generated mudflows. However, the dome, as it continues to grow, may become unstable and collapse forming "block-and-ash pyroclastic flow capable of rapidly melting large amounts of snow. Relatively small explosions and avalanches from the dome during the late winter and spring 1982-84 have generated a variety of mudflows. Numerous flows comparable

to those of March 19, 1982, and May 4, 1984, should be expected over the project life. Also scenarios that would generate mudflows larger than the two individual flows that comprise the Corps' design mudflow are not unreasonable.

Designing the sediment retention structure in a manner that allows for rapid drawdown of the sediment-trapping pool and for addition of future storage increments would help deal with the uncertainties concerning long-term erosion volumes and the magnitude and frequency of future mudflows. It is particularly important for the retention structure to be able to absorb a major mudflow without displacing a pool of water that could cause major downstream flooding.

During the design phase, the USGS will continue to transmit to the Corps all data and research findings that are germane to the effective mitigation of volcanic and hydrologic hazards associated with Mount St. Helens.

Thank you for the opportunity to comment on this document.

Sincerely,

Charles S. Polityka

Charles S. Polityka
Regional Environmental Officer

Responses to Department of Interior Comments:

1. To minimize the repetition of information, the final Coordination Act Report has been incorporated into the final Environmental Impact Statement by reference, in accordance with Council of Environmental Quality regulations. Please see Exhibit 1. All the information you have provided regarding fish and wildlife impacts in your Coordination Act Report is, therefore, part of the EIS. Regarding Spirit Lake, we assume the recommendations in your Coordination Act Report address your concerns.

2. As provided for by Council of Environmental Quality regulations, we have incorporated certain information by reference so that this information need not be duplicated in the EIS.

3. The issues referred to have been deleted from the unresolved issues discussion.

4. The alternatives chapter has been revised to more clearly identify the preferred plan.

5. Turbidity can be equated to quantity of suspended sediments, and the SRS will very effectively reduce the amount of suspended sediments downstream of the structure compared to the no-action alternative. In addition, our studies of trapping efficiency ratios versus discharge rates indicate that smaller particulates (silts) will be trapped at higher flows.

6. The assumption that you have referenced was used to facilitate and simplify our early analysis of this problem; this was stated as a preface to the statement you quote. The statement that rapid downstream physical and biological recovery will occur is a conclusion based upon the reduction of sediment transport and erosion which would occur with the SRS but not with the no action alternative. In previous coordination with your staff, we have discussed the change from a sand-bedded stream below the SRS that will occur when sediment input is reduced; the information provided in Appendix C and D support these conclusions.

7. Refer to EPA response #1.

8. Refer to EPA response #1.

9. Please refer to response #1.

10. Please refer to the Corps responses to the revised Coordination Act Recommendations provided by FWS in exhibit 1.

11. Thank you for your comments on this study. We will continue to coordinate and consult with your agency as planning progresses on this project.

12. The Feasibility Report contains several cautions such as those recommended.

13. To the extent that existing data will allow, the Feasibility Report does account for incision of the North Fork Toutle River, downstream transport of gravel, and storm impacts. These will be reviewed during CP&E sediment studies.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
ENVIRONMENTAL & TECHNICAL SERVICES DIVISION
847 NE 19th AVENUE, SUITE 350
PORTLAND, OREGON 97232-2279
(503) 230-5400

December 12, 1984 F/NWR5

RECEIVED
DEC 14 1984
REGULATORY FUNCTIONS BR.

Colonel Robert L. Friedenwald
District Engineer, Portland District
Corps of Engineers
P.O. Box 2946
Portland, OR 97208

Dear Colonel Friedenwald:

Thank you for providing the National Marine Fisheries Service (NMFS) the opportunity to review and comment on the "Mount St. Helens, Washington Feasibility Report and Draft Environmental Impact Statement." We reviewed the draft reports and offer the following comments for your consideration in preparing the final reports.

The NMFS is responsible for the preservation and enhancement of anadromous fish resources and the habitats that protect these resources. As described in the EIS, fall and spring chinook salmon, coho salmon, winter and summer steelhead trout and searun cutthroat trout utilized the Toutle River watershed prior to the eruption. Allowed sufficient time, the river is expected to gradually recover to its pre-eruption condition which would again support these fish resources. Our comments do not suggest that the No Action alternative be the preferred action plan, but are based on the premise that the resources have the potential to be restored naturally.

Considerable coordination occurred between the Corps and fish and wildlife resource agencies in identifying the resources of concern and the preferred plan to accommodate both the retention of sediments and the preservation of fish and aquatic/riparian habitats. Therefore, we confine our comments to preserving the passage of fish past the project area.

Of particular concern to this agency is the preservation of passage for both downstream and upstream migrating juvenile and adult salmonids, respectively. Juvenile fish must be able to navigate safely from their brood streams (tributaries to the North Fork Toutle River), through the sediment containment basin, and past the retaining structure. Adult fish must not be prevented from spawning in their home streams above the retaining structure.

Passage that the Corps of Engineers is proposing to develop is not identified clearly in the reports. The final reports should include a detailed description of the 1) construction, 2) operation and 3) maintenance plans for the fish passage and trapping facilities or a firm commitment by the Corps to have these plans approved by the NMFS prior to any construction activities.

Sincerely yours,

Dale R. Evans

Dale R. Evans
Division Chief

cc: Washington Dept. of Fisheries
Washington Dept. of Game
Fish and Wildlife Service, ES, Portland
Fish and Wildlife Service, Olympia

Response to NMFS Comments:

Detailed planning for a fish passage facility will be accomplished during the Continued Planning and Engineering stage of project planning. We propose to develop and plan these facilities in close cooperation with your agency.

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Centers for Disease Control
Atlanta GA 30333

December 14, 1984

District Engineer
U. S. Army Engineer District, Portland
Attention: NPPPL-NR
P. O. Box 2946
Portland, Oregon 97208

Dear Sir:

We have reviewed the Draft Environmental Impact Statement (EIS) for Mount St. Helens, Toutle, Cowlitz and Columbia Rivers, Washington. We are responding on behalf of the U.S. Public Health Service and are offering the following comments for your consideration in preparing the final document.

We understand that the purpose of the EIS is to disclose the environmental impacts of alternative plans to reduce the flood threat to life, property, and transportation systems in the Lower Cowlitz and Toutle River Valleys, and to maintain navigation on the Columbia River. Alternative plans include limited permanent evacuation, sediment stabilization basins, multiple retention structures with dredging, multiple retention structures without dredging, and a single retention structure.

According to the EIS, the effects of flooding are well-known to residents of the lower Cowlitz; floods have been a recurring problem for more than 100 years. Levees have been repaired and improved after several major flood events. For these reasons, we prefer the alternative plan of limited permanent evacuation and relocation. It would provide a more permanent solution of reducing the flood threat to 5,000 people. Improved efforts also need to be made to encourage affected communities to impose land use regulations in flood plains. Therefore, the alternative measure of Land Use Regulations which involves zoning restrictions and moratoriums on construction in flood threatened areas needs to be implemented in concert with the selection of any alternative plan.

1

While we fully support the use of a flood warning system to minimize any loss of life in the event of major flooding, its existence still does not guarantee full protection for those residents at risk, particularly for those residents located between flood protection levees and the river. Unless the warning system is accompanied by an emergency flood evacuation program, some residents may not be benefited. Physically handicapped individuals may not hear the warning system (as presented in the EIS) or may not be able to effect self-evacuation.

2 For your information, we commented on both the Draft and Final EIS for the Alternative Strategies for a Permanent Outlet for Spirit Lake near Mount St. Helens, Washington. Please refer to our February 8, 1984 and April 25,

2 1984 comments on the Spirit Lake EIS for our concerns related to permanent evacuation and relocation of sensitive land users in the flood plain downstream of Mount St. Helens, and water supplies downstream of construction activities. Any proposed dredging and construction activities associated with the alternative plans discussed above should notify operators of any surface water supply systems (that may be affected) prior to the commencement of any work. Efforts need to be taken to insure that intake waters of any surface water supply are of suitable quality for treatment and in compliance with the National Interim Primary Drinking Water Regulations.

We appreciate the opportunity to review the Draft EIS. Please send us one copy of the Final EIS when it becomes available. Should you have any questions about our comments, please contact Mr. Robert L. Kay, Jr., of our staff at FTS 236-4161.

Sincerely yours,

Stephen Margolis

Stephen Margolis, Ph.D.
Chief, Environmental Affairs Group
Environmental Health Services Division
Center for Environmental Health

Responses to Public Health Service Comments:

1. The alternative of limited permanent evacuation was considered in the first phase of study of a sediment control solution. This alternative was dropped from further consideration and was not carried forward into the Feasibility Study. This alternative would be the most expensive to implement, and would not satisfy a primary study objective of reducing impacts to navigation in the Columbia River. The results of our public involvement program indicated little support among residents of the affected area for this alternative. As we have reported in our Feasibility Report, the preferred plan, a sediment retention structure with associated downstream actions, is the most cost-effective and efficient solution to the sediment control problem.

2. We concur with your recommendation.

State of Washington

JOHN SPELLMAN, Governor

December 13, 1984

OFFICE OF THE GOVERNOR

Col. Robert Friedenwald
U.S. Army Corps of Engineers
Portland District
P.O. Box 2946
Portland, OR 98728-2946

ATTN: NPPPL-AP

Dear Colonel Friedenwald:

Thank you for the opportunity to review the U.S. Army Corps of Engineers (COE) draft Mount St. Helens, Washington Feasibility Report and Environmental Impact Statement. I have directed the state agency task force on Mount St. Helens to review this document and respond to me with its comments and recommendations. Comment letters from these agencies are enclosed.

The state of Washington supports the COE preferred alternative of a single retention structure at the Green River site. As I stated in my December 16, 1983, letter to the President responding to the Comprehensive Plan, the traditional cost sharing formula should apply and include costs for fish and wildlife mitigation measures. Although the state is pleased that a fish trap and haul facility will be constructed, it would seem that operation and maintenance of this facility should be a Federal responsibility as it has been on other Federal projects in the state. Also, in the final Environmental Impact Statement, the state would like to see other mitigation measures considered such as monitoring and fish passage during the construction of the project. These measures are spelled out in more detail in the enclosed agency letters.

With the exception of the mitigation measures mentioned above, the cost share formula presented in the Feasibility Report is consistent with what the state has requested in the past. The state is willing to participate with the COE on this vital project and to pay its fair share under the traditional cost sharing formula. The state of Washington will begin the process to provide the necessary funds by proposing legislation for consideration by the 1985 Legislature.

Thank you again for the opportunity to respond. If you have any questions, please contact Mr. Hugh Fowler, Director, Department of Emergency Management. We look forward to working with the COE in any way in the next phases of this process, as implementation of permanent corrective measures must begin as soon as possible.

With best wishes,

Sincerely,

John Spellman
Governor

Enclosures

cc: Robert Dawson, Acting Assistant Secretary of the Army (Civil Works)
Congressional Delegation

Response to Governor Spellman's Comments:

Thank you for providing your views on this study. Our responses to comments from State of Washington agencies follow each agency letter. Your views will be included in the official record which will be provided to Administration officials for their consideration in making their recommendations to Congress for project authorization and funding.

JOHN SPELLMAN
Governor

WILLIAM R. WILKERSON
Director

STATE OF WASHINGTON
DEPARTMENT OF FISHERIES
115 General Administration Building • Olympia, Washington 98504 • (206) 753-6600 • (SCAN) 234-6600

December 4, 1984

Department of Ecology
Environmental Review Section
St. Martin's Campus
Lacey, Washington 98504

Gentlemen:

U.S. Army Corps of Engineers- Mt. St. Helens, Washington Feasibility Report and Draft Environmental Impact Statement, Toutle, Cowlitz, and Columbia Rivers, WRIA E-26

1 We have reviewed the above-referenced feasibility report and Draft Environmental Impact Statement (DEIS). We feel the U.S. Corps of Engineers (Corps), given the unpredictable nature of Mt. St. Helens and the uncertainty regarding the rate and manner of sediment delivery from the existing mud flow, to downstream areas, has done an adequate job of evaluating the various alternatives to alleviate the threat of downstream flooding and disruption of navigation.

2 The Department of Fisheries will not object to the preferred alternative, a single retention structure (SRS) at the Green River site, provided the Corps fully mitigate the impacts of the project as recommended by the final U.S. Fish and Wildlife Service's Coordination Act Report (Fisheries' concurrence letter attached).

3 We are pleased that fish passage for adult and juvenile salmonids will be provided at the SRS. We are not pleased the Corps feels fish passage will mitigate for all other fish habitat impacts of their work.

4 The Corps states on Page X-2 "This Feasibility Report presents the best estimate as to the amount and timing of sediment movement under normal hydrologic events. However, not withstanding the accuracy of predicting sediment movements and other events, any program should provide the flexibility to adjust to actual conditions." They also state on Page X-1 "Continued close cooperation among federal, state and local agencies, as well as continued professional monitoring of the erosion process, will facilitate adjustments to any programmed solutions."

5 It is our position that these statements should also apply to mitigation of fishery impacts. For example, the Corps has placed heavy emphasis on the ability of the SRS to enhance the recovery of downstream habitat. While we hope this is so, we have no assurance as to what extent or in what manner recovery will occur or if recovery will be a return to usable spawning and rearing habitat for salmon.

6 We do know Alder Creek, for example, is in good fish producing condition and that the lower four miles of this stream will be negatively affected by the SRS.

7 The DEIS does not address impacts during construction such as the extensive excavation required for the foundation of the dam. It does not adequately discuss how the cofferdam will be constructed or how the fish trap and haul barrier dam will be constructed. No reference is made to maintenance of fish passage during construction.

8 We could not tell how the Corps developed its water temperature scenario for the reservoir and are not convinced a rise of six to seven degrees Fahrenheit is insignificant and will fall rapidly after passing the SRS.

9 These examples demonstrate the Corps' analysis of fishery impacts is their best estimate. Further, the Corps is committed to monitoring the mud flow and the success of their projects to achieve flood control and to assure safe navigation and is also committed to adjusting their projects as a result.

10 We feel monitoring both construction and post-project impacts is also important and prudent to insure fishery mitigation measures are successful and complete. This approach is not without precedent. The Corps' Wynoochee project is an example where mitigation for downstream passage mortality was derived through a monitoring study. Corps dredging in Grays Harbor has been monitored for fishery impacts and operations modified to reduce those impacts.

11 This is not to say we need all the answers before construction. It would not be prudent to delay this project while studies are done. It is reasonable to monitor and mitigate for impacts in a manner which will not affect the construction schedule.

12 The Corps proposes the State of Washington pay operation and maintenance (O & M) costs for fish facilities at the SRS. This proposal is unacceptable. The SRS is a Federal Project and mitigation is a Federal responsibility. Numerous projects within Washington State have fish facilities operated and maintained by the Corps including fishways on Columbia River dams, Wynoochee Dam fish facilites and the Mud Mountain Dam trap and haul facility. We feel the SRS should be operated and maintained in the same manner.

We look forward to working with the Corps and the U.S. Fish and Wildlife Service in the design and construction phase of this project to insure reasonable fish mitigation measures are implemented.

Thank you for this opportunity to comment.

Sincerely,

Duane E. Phinney for
William R. Wilkerson
Director

Attachment

Responses to Dept. of Fisheries Comments:

1. Comment noted.

2. Please refer to our responses to the recommendations by the U.S. Fish and Wildlife Service, which are included with the Coordination Act Report in Exhibit 1 of the Main Report.

3. We will continue to evaluate fish and wildlife impacts and mitigation, as well as all engineering features, during the Continued Planning and Engineering stage.

4. This study is a feasibility study, a level of study which does not result in development of project design and construction details. This information will be developed in the Continued Planning and Engineering stage.

5. This analysis was developed in accordance with generally accepted methodologies. Details of the methods and findings can be obtained by contacting our Hydraulics and Hydrology Branch.

6. We have responded to the need for certain monitoring activities in response to U.S. Fish and Wildlife Service's recommendations: please refer to our responses to their recommendations.

7. Comment noted. Our cost-sharing proposals are shown in the Feasibility Report.

JOHN SPELLMAN
Governor

WILLIAM R. WILKERSON
Director

STATE OF WASHINGTON
DEPARTMENT OF FISHERIES
115 General Administration Building • Olympia, Washington 98504 • (206) 753-6600 • (SCAN) 234-6600

December 3, 1984

Richard J. Myshak
Regional Director
U.S. Fish and Wildlife Service
Lloyd 500 Building, Suite 1692
500 Northeast Multnomah
Portland, Oregon 97232

Dear Mr. Myshak:

Coordination Act Report - Final Draft, The Impacts on Fish and Wildlife of Proposed Sediment Control Action for the Toutle, Cowlitz and Columbia River Systems

We have reviewed your final draft Coordination Act Report (CAR) and generally agree with its contents. Your assessment of the effects of the proposed projects is adequate given the Corps of Engineers' uncertain estimates of the manner in which the sediment will be delivered from the North Fork Toutle River and the ambiguity which exists as to how the projects will affect the "recovery" of the watershed.

This most clearly demonstrates the need for general recommendations 2 - 5 which request complete monitoring of the effects of these projects during construction and after to more specifically identify mitigation measures necessary for the protection of fish and wildlife.

We concur with the remaining general recommendations aswell as the specific recommendations except for Toutle River Number 6 and Cowlitz River Number 1. We do not feel the measures are necessary or feasible to implement.

Thank you for the opportunity to provide input into the earlier drafts of this CAR and to provide you with this letter of concurrence on the final report.

Sincerely,

Duane Phinney for
William R. Wilkerson
Director

cc: Keller
Mohoric
Zillges

JOHN SPELLMAN
Governor

JACOB THOMAS
Director

STATE OF WASHINGTON
OFFICE OF ARCHAEOLOGY AND HISTORIC PRESERVATION
111 West Twenty-First Avenue, KL-11 • Olympia, Washington 98504 • (206) 753-4011

November 14, 1984

RECEIVED
NOV 16 1984
DEPARTMENT OF ECOLOGY
ENVIRONMENTAL REVIEW

Ms. Barbara Ritchie
NEPA Coordinator
Dept. of Ecology
Mail Stop PV-11
Olympia, WA 98504

Log Reference: 584-F-COE-P-06

Re: Sediment Retention Structure
North Fork Toutle River

Dear Ms. Ritchie:

A staff review has been completed of the Mount St. Helens, Washington, Feasibility Report and Environmental Impact Statement and the technical cultural resources survey report. Based on the information provided for our review, in our opinion the proposed project will have no effect on known archaeological or historic resources included in or eligible for inclusion in the National Register of Historic Places.

Thank you for this opportunity to comment.

Sincerely,

Robert G. Whitlam, Ph.D.
State Archaeologist
(206) 753-4405

dw

cc: Byron Blankenship

JOHN SPELLMAN
Governor

KAREN RAHM
Secretary

STATE OF WASHINGTON
DEPARTMENT OF SOCIAL AND HEALTH SERVICES
MEMORANDUM

TO: Barbara Ritchie, Department of Ecology
Environmental Review Section
Mail Stop PV-11

DATE: December 3, 1984

FROM: Bill Maibauer BM

SUBJECT: Mount St. Helens Feasibility Report and EIS for the Sediment Retention Structure

The Water Supply and Waste Section of the Department of Social and Health Services requests that this project for the sediment retention structure be pursued as rapidly as possible. Our concerns for the public water supplies serving the residents downstream of the proposed structure have been met. Since the Mount St. Helen's explosion on May 18, 1980 these needs were met by construction of the Castle Rock - Toutle regional water system, additions to the Longview water treatment plant, and the new Kelso water treatment plant. We will push for an expeditious construction schedule for this structure.

WHM:sb

cc: Jim Hudson
Bill Liechty

DEPARTMENT OF ECOLOGY
OLYMPIA, WA 98504
DEC 5 9 01 AM '84

JOHN SPELLMAN
Governor

DONALD W. MOOS
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
7272 Cleanwater Lane, LU-11 • Olympia, Washington 98504 • (206) 753-2353

MEMORANDUM

December 4, 1984

TO: Barbara Ritchie, Environmental Review

FROM: Gary Hanson, Southwest Regional Office G.H. by GH

SUBJECT: U. S. Army Corps, Mt. St. Helens, Washington, Feasibility Report

The preferred plan, a single high dam above the confluence of the Green River, is essentially the solution that we have suggested for the sedimentation problem.

A couple of points that could be considered further are:

1. What would the impact be on this plan if a 10 - 25 year frequency flood occurred on the Toutle River before the dam is constructed?

2. What are the estimates for a gravel budget in the Toutle River downstream of the dam and how much of that gravel will be from the Green River?

The Washington Department of Ecology (WDOE) has the responsibility for administering several programs that may require permits, approvals, or review by our agency; including water rights, NPDES permits, short-term exceptions to water quality standards, and dam safety.

GH:cl(2:3)

Responses to Dept. of Ecology Comments:

1. We have recommended in the feasibility study that prompt action be taken to implement recommended actions since an event of large magnitude could adversely affect downstream areas.

2. Our foundation explorations show a great abundance of gravels in the Toutle River system.

JOHN SPELLMAN
Governor

FRANK LOCKARD
Director

STATE OF WASHINGTON
DEPARTMENT OF GAME
600 North Capitol Way, GJ-11 • Olympia, Washington 98504-0091 • (206) 753-5700

December 3, 1984

Lieutenant Colonel Jon D. Katin
Acting District Engineer, Portland District
U.S. Army Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208-2946

DRAFT ENVIRONMENTAL IMPACT STATEMENT:
Mt. St. Helens, Washington -
Feasibility Report

Dear Lieutenant Colonel Katin:

Your document was reviewed by our staff as requested; comments follow.

1 We are in overall concurrence with your feasibility report and DEIS. Your preferred alternative is clearly the least impacting proposal. Features to lessen adverse effects have been included in project design. In addition, your descriptions of impacts on fish and wildlife generally appear to be accurate.

However, important areas of disagreement exist. For example, we do not believe that in-stream productivity below the Green River site will recover as quickly as you project. This issue influences the success of mitigation measures. Clearly, permanent loss of potential habitat for anadromous fish will occur from project implementation, even with fish passage provided.

2 We disagree, as well, on the issue of operations and maintenance funding for fish passage facilities. Our experience is that the Corps of Engineers has been responsible for funding fish and wildlife mitigation programs at Corps-owned and operated dams in the state of Washington. Examples are Wynoochee Dam on Wynoochee River and Mud Mountain Dam on White River.

Finally, we reiterate our concurrence with your choice of the preferred alternative. The following recommendations are given to help design and implement an effective mitigation plan.

1. Greater consideration should be given to all measures proposed in the final U.S. Fish and Wildlife Service's Coordination Act report.

2. A technical committee of state and federal fish and wildlife resource agency personnel should be established to review plans and give advice on mitigation issues.

3. Studies for planning, feasibility and design of fish and wildlife mitigation resources should coincide with other project features, beginning with receipt of FY 85 planning and design funds.

2 4. Fish passage should be provided at all times during and after construction.

5. Monitoring of fish and wildlife response to construction and mitigation actions should begin at project initiation, and continue until mitigation needs are satisfied.

Thank you for giving us the opportunity to respond to your document.

Very truly yours,

THE DEPARTMENT OF GMAE

Frank R. Lockard
Director

FRL:pr-b

Responses to Dept. of Game Comments:

1. Comment noted.

2. Please refer to similar recommendation provided by U.S. Fish and Wildlife Service and our responses to those recommendations which are included with the Coordination Act Report in Exhibit 1 of the Main Report.

Willapa Hills Audubon Society

P. O. Box 93 - Longview, WA 98632

November 28, 1984

Colonel Robert L. Friedenwald, District Engineer
Portland District
U.S. Army Corps of Engineers NPPPL-AP
P.O. Box 2946
Portland, Oregon 97208

Dear Colonel Friedenwald:

The Willapa Hills Audubon Society supports the selection of the Green River site for construction of a sediment retention dam to control flooding in the Toutle, Cowlitz and Columbia Rivers. This site poses the least adverse effects on fish and wildlife resources.

We recommend that fish and wildlife be made an authorized purpose of the dam project to ensure that appropriate mitigation measures for habitat losses are implemented. While losses would not be as severe with the Green River site, as with the other alternatives, impacts still would occur and they must be mitigated.

Continued fish and wildlife habitat protection throughout the life of the project would be needed. A monitoring program should be established to assess the effectiveness of protection and mitigation efforts.

Adequate funding should be included in project budget requests to properly mitigate fish and wildlife habitat losses as recommended by state and federal resource agencies. Mitigation activities may include fish passage and rearing facilities, riparian zone protection, and wildlife habitat enhancement. We believe funding for fish and wildlife habitat protection and mitigation of losses should come from the federal government. The beneficiaries of fish and wildlife habitat protection and mitigation of losses are not limited to the local community or even the State of Washington. Anadromous fish are a regional, national and international resource; migratory birds are a regional and national resource. Furthermore, local and state governments cannot afford to implement the recommended mitigation and protection measures or to maintain them over the life of the project. For example, the fish trap is estimated to cost $1 million to construct and $100,000 a year to maintain and operate. If left to local and state governments to fund, there is a very real danger that fish and wildlife mitigation would never be implemented. Therefore, the cost-share proposal is unacceptable.

Sincerely,

Mark Chilcote
President

AMERICANS COMMITTED TO CONSERVATION

Recycled Paper

Response to Willapa Hills Audubon Society Comments:

Please refer to similar recommendations by U.S. Fish and Wildlife Service and our responses to those recommendations which are included with the Coordination Act Report in Exhibit 1 of the Main Report.

Weyerhaeuser Company

Longview, Washington 98632
A/C 206 · 425-2150

December 14, 1984

COL. R. L. Friedenwald
Department of Army
Portland District, Corps of Engineers
P. O. Box 2946
Portland, Oregon 97208

Dear COL. Friedenwald:

The purpose of this letter is to offer Weyerhaeuser's comments on the draft Mt. St. Helens Feasibility Report. One year ago Weyerhaeuser joined with others in urging the Corps to begin construction of a permanent outlet for Spirit Lake. With that project nearing completion, we commend the Corps of Engineers for your prompt response. Like the Spirit Lake tunnel project, the transport of sediment through the Toutle, Cowlitz and Columbia River systems is a complex problem with very costly solutions.

Weyerhaeuser has a large stake in the sediment and flood control efforts in the Toutle and Cowlitz River valleys. Not only are we the largest land owner in the Toutle drainage, but our 670 acre Longview mill site includes improvements valued at close to $1 billion. Our pulp and paper facilities are currently involved in major capital investment projects. Our timberlands and manufacturing facilities support over 4,000 jobs with an annual payroll in excess of $155 million. With a high level of interest, we offer comment on three items: SEDIMENT BUDGET, ALTERNATIVE SELECTION, AND FUNDING.

<u>SEDIMENT BUDGET</u>

Selection of a management strategy is primarily driven by the source, amount and timing of sediment transport. Information on the dynamics of these critical elements remains incomplete. The Corps most recent Sedimentation Study reinforces this position by concluding that major downward revisions were needed in the sediment budget. We support the Corps determination that monitoring and refinement of sediment data should continue. Uncertainties in the following areas highlight the need for additional information:

- The absence of an intense storm event during the 3-year study.
- Record rainfall in water year 1984 not included in the study.
- Dynamics of scour/infill patterns.
- Re-entry of sediment from spoils disposal sites.
- Rapid re-establishment of stream channels.
- Rapid recovery of the South Toutle and Green River.
- Sediment contribution from current Spirit Lake pumping versus the tunnel outlet.
- Significant bank erosion on Toutle and Cowlitz rivers.

These uncertainties demonstrate the complexity of processes effecting sediment projections. We support strengthening sediment transport data prior to final selection of a management strategy.

<u>ALTERNATIVE SELECTION</u>

The Feasibility Report recommends that a 177-foot Single Retention Structure (SRS) be constructed to trap sediment. If it is finally determined, after <u>additional</u> monitoring, that the SRS is justified, Weyerhaeuser would support the Green River site for location of the structure.

As the major landowner within the proposed SRS project boundary, Weyerhaeuser will suffer major damage to forestland inside the project as well as added cost of managing lands surrounding the SRS. Included are:

- Timber of various ages.
- Land.
- Roads and bridges - both public and private.
- Log handling facilities.
- Railroad routes.
- Minerals.
- Power and utilities.
- Severance damages.

Specific measures described in the Feasibility Report to minimize impacts of the project on fish and game are sufficient. Weyerhaeuser is committed to long term forest management on its St. Helens Tree Farm. Inherent in this commitment is the maintenance of normal forest practices which are compatible with fish and game resources. Weyerhaeuser will resist any attempts to expand mitigation measures to involve additional land or forest management restrictions.

<u>FUNDING</u>

Development of any management strategy must include full identification of all costs to all parties. We support traditional funding methods as the fair and most rapid approach to get the job done. At issue is the threat to lives and property resulting from a natural disaster. The threat to

commercial navigation in the Columbia and Snake River systems affects several states in this region. In addition, the bulk of erodible sediment originates in the National Volcanic Monument on federal land. In view of these conditions, funding of a solution is an appropriate role for the Federal government. Congressional authorization and funding must include prompt compensation to all property owners affected. The Corps dredging program on the lower Toutle and Cowlitz River has effectively provided flood protection. Funding for this maintenance dredging must continue.

In summary, continued monitoring and refining of the sensitivity analysis is needed before an appropriate management strategy can be selected. We appreciate the opportunity to comment on your draft Feasibility Report and Environmental Impact Statement.

Sincerely,

C. H. Wiggins
Vice President
Southwest Washington Region

CHW:sj
07/121484

cc: Mr. Lloyd Stoats
Resident Engineer
Army Corps of Engineers
P.O. Box 190
Castle Rock, WA 98611

Responses to Weyerhauser Co. Comments:

We agree that continued monitoring and refinement of the sediment budget is needed. However, the high cost of continuing interim dredging, to prevent flooding and navigation blockage, requires that steps continue to implement a solution. We are continuing planning and engineering on single and staged retention structures along with dredging alternatives. This will minimize delays if new sediment information indicates another alternative is more cost effective.

A. H. Jones
12-10-84

Comments Concerning
Mt. St. Helens, Washington, Feasibility Study

The task of evaluating the river problems created by the eruption of Mt. St. Helens is not an easy one. These problems are not only, as described by the Army Corps of Engineers, "unlike any others experienced in the United States," but the erosion process has refused to settle into a consistent pattern thus becoming, in effect, a moving target for the Corps' evaluation marksmen.

Comprehensive Plan was published in November, 1983, and within a few months was recognized to be out of date. The target had moved.

Sedimentation Study/1984 was released in September, 1984, as an update of Comprehensive Plan with extensive revisions of the earlier evaluation. The revisions included:
1) forecast of 50-year erosion reduced from 1 bcy to 650 mcy.
2) forecast of 1985 erosion reduced from 50 mcy to 28 mcy.
3) capacity of proposed dam reduced from 712 mcy to 299 mcy.
4) cost of preferred project reduced from $342 million to $292 million.

Among the reasons why Comprehensive Plan missed the target are these:
1) forecasts of erosion were too high because they were based on early post-eruption winters when erosion was high.
2) erosion reports for recent winters, showing erosion decline, have been repeatedly delayed for one year.
3) unrealistic worst-case interpretations have characterized the evaluation system.

Those same defects have been repeated in the 1984 Sedimentation Study and in the recent Mt. St. Helens Feasibility Report. Data bases much too high, critical reports not available and unrelenting emphasis on worst-case conclusions may have flawed the credibility of the two documents.

The Corps' preferred plan is for a sediment dam in the Toutle River valley. This seems strange for the Corps has not yet verifiably defined the problem that the dam would theoretically solve. Two studies of the problem within the last year have produced answers far apart. The Corps has promised to continue its studies and, if erosion on the avalanche continues to change as drastically as before, the next report will produce still another set of answers.

It appears that the Corps guessed wrong in the beginning, assuming that erosion rates would remain high and might go higher. Erosion has done neither of these and has actually declined significantly, leaving the Corps constantly trying to catch up. Perhaps the Corps should recognize the reality of declining erosion and address the problem from a different direction.

There is no doubt that a person with realistic inclinations could take the same facts and figures used by the Corps and write a completely different report. Following are typical paragraphs from Feasibility Report, citing their defects and showing how they could be rewritten to correct mistakes, revise biased statements and replace worst case conclusions with optimism. The examples are numbered for reference.

1. Feasibility Report says on page I-1: "Further refinement of the plan presented in this report will occur during the Continued Planning and Engineering (CP&E)."

Overhaul of the plan was something more than a "refinement" and credibility of the report would be increased if spades were always called spades. The statement preferably would say: "The plan presented in this report is a major revision of the earlier plan and we anticipate further revision will be necessary when delayed data is available and new studies are complete."

2. Feasibility Report says on page I-4: "The revised sediment projections discussed in this report fall within the ranges of both total sediment erosion and annual rates of sediment delivery presented in those (Comprehensive Plan) sensitivity studies."

The Corps undoubtedly wishes this were true. However, it is not. The statement should say: "The revised sediment projections discussed in this report fall partly within and partly below the ranges of total sediment volume and annual sediment rates presented in Comprehensive Plan. This is due to our findings of sharply reduced current erosion. In Comprehensive Plan, a total sediment range of 400 mcy to 1 bcy was discussed; in Feasibility Report a range of 325 mcy to 975 is discussed. In Comprehensive Plan, an annual range of 30 mcy to 70 mcy was discussed; in Feasibility Report, various high ranges were discussed and an initial high rate of 28 mcy was chosen.

3. Feasibility Report says on page I-4: "The revised sediment projections discussed in this report fall within the ranges of both total --- and annual --- sediment delivery presented in (Comprehensive Plan)."

Comprehensive Plan and Feasibility Report not only discussed ranges of total and annual erosion but they also were very specific in making forecasts. The discussion of ranges was simply a method of arriving at the answers, and secondary in importance to the results. An informative wording might have said: "The revised sediment projections presented in this report were adopted following discussion of a wide range of total and annual erosion rate

possibilities, the lower range of which fell outside of the range of Comprehensive Plan discussions. As a result, the new forecasts are significantly below the earlier predictions: 650 mcy instead of 1 bcy for total erosion and 28 mcy instead of 50 mcy for year-1985 erosion."

4. Feasibility Report says on page I-4: "--- new information developed since completion of the Comprehensive Plan --- refine the projections on sediment movement and deposition."

The new information did more than refine the projections; it extensively revised them. A more realistic report of what happened would say: "Critical information which was late in coming to the Corps has caused the projections of sediment movement and deposition to be drastically revised."

5. Feasibility Report says on page I-10: "During the eruption, the avalanche --- (blocked) outlets to existing lakes."

Spirit Lake was the only Toutle basin lake whose outlet was blocked by the avalanche. This error may be small but any inaccuracy in a report such as this is a reflection on the objectivity of the document. The statement might say: "Following the eruption, the avalanche blocked the outlet to Spirit Lake, buried the upper North Toutle River and some of its tributaries, then moved down the valley blocking the outlets to other streams."

6. Feasibility Report says on page I-15: "A drastic reduction in the total sediment yield, from 1 bcy to 400 mcy would result in strategy 2 (SSB) being less expensive than strategy 5 (SRS)."

The statement reaffirms a Comprehensive Plan conclusion that for total sediment yields up to 400 mcy the sediment stabilization basins are the least costly alternative. The cost advantage for SSB is illustrated in Table I-2 on page 15 of Feasibility Report. The statement above would have been more informative if it had said: "The drastic reduction which has occurred in current sediment yields strongly indicates that total sediment yields have dropped below the 400 mcy level where cost advantages will shift from retension structures to dredging from stabilization basins. If this reduction is confirmed, we will find it advisable to change our preference from the high dam to the dredging program."

7. Feasibility Report, in Table I-3 on page I-15, compares the cost for disposing of three assumed annual sediment yields under five alternative management strategies.

The assumed yields do not include a column representative of the current rate of sediment movement. The table predictably shows SRS costs to be the most favorable. Actually the table is not relevent to the current sediment situation,

since its range of annual sediment yields does not drop low enough to include the present rate of sedimentation as measured by the ongoing dredging operation. It would be realistic to revise the table to include a column for 10 mcy annual sediment delivery.

8. Feasibility Study says on page II-1: "The sediment budget used in the report is based on observed erosion and sediment movement --- during the past four years."

This statement is refuted on page II-7 where it is indicated that, if any observations were made after September 30, 1983, they were not used in establishing a sediment budget. The statement should say: "The sediment budget used in this report is based on our observations of erosion and sediment movement prior to September 30, 1983. During the preparation of this report, erosion and sediment data was not available for WY 1984 which included the fourth post-eruption winter. The omission of this critical information probably detracts from the validity of the sediment forecast and we realize the urgency to acquire the delayed data and to restructure the sediment budget."

9. Feasibility Report says on page II-1: "The uncertainties associated with the sediment budget developed for this report, as well as for the Comprehensive Plan, have been dealt with by performing sensitivity analyses on proposed management alternatives."

The statement implies that the difficulty of determining what the declining erosion process will do next has been successfully overcome. That is definitely not the case. The statement realistically should have said: "The uncertainties associated with sediment movement have made the development of a sediment budget very difficult. Sensitivity analyses have been performed on proposed alternatives but the basic data is so unrealiable, due to the constantly changing erosion process, that we are not comfortable with our sediment projection. We will, of course, continue our field observations and the annual updating of the sediment budget."

10. Feasibility Report says on page II-1: "These projections are unable to reflect possible large-scale erosion caused by unusual events. For example, the largest storm during the past 4 years had less than a 10-year occurrence frequency."

This does not tell the whole story. It would have been more informative to have said: "Although there has been no record-breaking storm event in the Toutle River watershed since the eruption, rainfall has been heavy. Rainfall records were kept at Spirit Lake from 1932 to 1956 and from October, 1983, to the present. For the months when rainfall was recorded at Spirit Lake, November, 1983, reported the second highest total with 29.62 inches for the month including 3.33 inches on one day. While these are not records, they are heavy, sustained rainfalls and it is significant that no unusual erosion or flooding occurred. Rainfall

records have been kept continuously at Longview since 1923 and these show that Spirit Lake rainfall is consistently about double the Longview measurement. Since Longview records indicate that annual rainfall has increased every year since 1979 and has been substantially above the average each year, we can assume that more than 100 inches of rain has fallen on the debris avalanche every year since the eruption. While not enough to cause a deluge, it may have been sufficient to test the stability of the debris."

11. Feasibility Report says on page II-6: "Sediment yields from the debris avalanche are expected to remain high throughout the 50-year project life."

Sediment forecasts for just one year have been far off the target and it is unlikely that expectations for the next 50 years will be any closer. It would have been sufficient to say: "Sediment yields from the debris avalanche were understandably high during the early post-eruption years but the yields have dropped sharply since the second winter following the eruption. Inasmuch as tributary streams are generally clear and the outlet tunnel from Spirit Lake will bypass six miles of the North Toutle River where it crosses the avalanche, we see good reasons to expect that yield from the avalanche will continue its decline and will remain substantially below the erosion rates of the past."

12. Feasibility Report says on page II-12: "The Comprehensive Plan --- assumed an initial rate of erosion equal to the then-estimated WYs 1981 and 1982 average of 50 mcy/year."

A better explanation would have said: "Comprehensive Plan estimated the erosion in WYs 1981 and 1982 to be 31 and 34 mcy respectively. The average of 32.5 mcy for the two years did not seem high enough for forecast purposes so we chose to call the average 50 mcy. We know now that we erred because the following year produced only 18 mcy of erosion from the avalanche. We are not yet ready to consider that figure indicative of current erosion rates, so we are forecasting 28 mcy for 1985. Our field reports of erosion are lagging one year behind but as soon as current data is available, we will formulate another forecast."

13. Feasibility Report says on page II-12: "The annual erosion rate has been reduced but continues at a uniform rate."

Erosion rates for WYs 1981, 1982 and 1983 were estimated on page II-7 to be 31, 34 and 18 mcy, respectively. It is doubtful that this can be regarded as an indication of uniformity. The absence of an estimate of erosion for WY 84 adds to the mystery of how anyone could judge the erosion rate to be continuing at a uniform rate. Evidence indicates that the statement could say no more than this and still be factual: "The annual erosion rate has declined and the last field report indicated a sharp drop in 1983. We cannot anticipate what the WY 1984 report will reveal but there seems a strong possibility that further decline will be noted."

14. Feasibility Report says on page II-21: "-- Comprehensive Plan showed a single retention structure (SRS) as the least costly solution to the sediment problem within the total sediment yield range of 400 mcy to 2 bcy."

Comprehensive Plan apparently does not say that. If the reference is to page VI-7 in the Plan, it will bear reading again. It says: "If the sediment yields are low (i.e. 400 mcy), the SSB (sediment stabilization basin) strategy has the lowest cost." Table VI-2, also on page VI-7, shows the SSB cost for a yield of 400 mcy is $218 million whereas the SRS cost for the same yield is $275 million. The statement should have said: "---Comprehensive Plan showed sediment stabilization basins to be the least costly solution for sediment up to and somewhat above 400 mcy. For higher volumes the single retention structure appeared to be the least costly."

15. Feasibility Report says on page II-21: "The revised sediment budget indicated the feasibility of a smaller structure ---. However, additional storage needed for --- flood events and mudflows dictated that a structure the same size as in the Comprehensive Plan still was needed."

Comprehensive Plan erosion estimates have been drastically revised. To say that the proposed dam, which was intended to handle the higher volume, still is required is irrational. The statement would be realistic if it said: "The revised sediment budget indicates the feasibility of a smaller structure, which, frankly, is the only dam which can be statistically justified at this time. Because of delayed erosion data, we aren't even sure how small the dam should be. However, if it is agreed that, in the interest of caution, provision should be made for trapping mudflows or storm events which may or may not occur, then it might be advantageous to choose a dam with greater storage. We believe that mudflows and storm events are a possibility and, in order to play safe, we recommend a structure the same size as in the Comprehensive Plan."

16. Feasibility Report says on page II-21: "The new total sediment yield from the debris avalanche approximates 750 mcy and the annual sediment yield 28 mcy/year, beginning in 1980."

This is a garbled sentence which perhaps intended to quantify two factors and actually confused both. Following may have been the intention: "The new total sediment yield from the debris avalanche is predicted to be 750 mcy during 55 years beginning in 1980 following the eruption and the declining annual sediment yield is forecast to be 28 mcy in 1985."

17. Feasibility Report says on pages II-21/22: "--- the total quantity of sand delivered over the project life remains virtually the same as in the Comprehensive Plan."

This is an incredible mathematical coincidence when we consider the drastically declining erosion from the avalanche and the low volume of sand that has been dredged from the combined Toutle, Cowlitz and Columbia Rivers. It might have been more acceptable to have said: "--- the total quantity of the sand portion of the eroded material expected to be delivered over the project life was calculated to be similar to the volume estimated in the Comprehensive Plan. This projection will probably be changed after we receive the delayed erosion data and review the overall dredging information."

18. Feasibility Report says on page III-5: "Structure design includes fish by-pass facilities for anadromous fish."

Most people reading this statement will get a clear picture of a fish ladder or lift of some kind. Nothing of this kind is being planned. What is being considered is a provision for trucking the fish from the river below the dam to the pool above the dam. The statement should have said: "The structure to be designed is not expected to include any facility for passing anadromous fish over the dam. If any provision is provided for fish passage around the dam, it will be separate from the structure itself and will possibly consist of a holding pool for the fish below the dam and a tank truck to transport the fish around the structure."

19. Feasibility Report on page IV-9 lists advantages of a single retention structure and adds: "It also would cause the least disruption of the physical environment and related resources."

This is not a true statement and it would be better to say: "Regrettably the dam would environmentally damage 6 miles of the North Toutle River, 5 migratory-fish creeks and 4,100 acres of river valley land, all of it downstream from the 16 miles of river damaged by the mudflow of May 18, 1980. This is far more disruption than would be caused by a smaller dam, a dam located farther upstream or by dredging from sediment stabilization basins."

20. Feasibility Report says on page IV-14: "Appendixes C and D present the details of the estimated sediment budget --- of 750 mcy for the next 50 years."

The volume of 750 mcy does not conform to Sedimentation Study/1984 most of which was incorporated into Feasibility Report as Appendix C. SS/1984 says at the bottom of page 2: "The total erosion from the debris avalanche during the next 50 years would be approximately 650 mcy." The use of 750 mcy instead of 650 makes the sedimentation situation appear more severe than it really is. It is unfortunate that this error was continued throughout Feasibility Report, and even into the calculations for Sediment Budget E.

21. Feasibility Report says on page IV-14: "The Corps' current estimate of future sediment is the E sediment budget (of 750 mcy), since it has the highest probability of occurring."

In view of the difficulty in predicting sediment probabilities, it might have been better to say: "The Corps' current estimate of future sediment is the E sediment budget of 650 mcy. However, erosion from the debris avalanche has declined so drastically during the last two years that we have no basis for confidence in our E budget. It is the best estimate that can be made at this time and we will not be surprised if it requires revision in a short time."

22. Feasibility Report says on page V-14: "In sum, the preferred plan would strengthen the underlying economic base of Cowlitz County and enhance its quality of life."

If this is a major and verifiable benefit of the dam project, it should be publicized extensively.

23. Feasibility Report says on page VI-11: "Results from this table (Table VI-4) indicate that for a 1/2 sediment budget, dredging is always the least costly solution."

The sediment budget has been set at 650 mcy for the 50-year life of the project. This probably will be reduced when current field data becomes available but, even so, one-half of the budget is 325 mcy and that is in the range of what we are talking about. The proposed dam would have a preferred trapping capacity of 299 mcy, which is less volume than the 1/2-budget figure. Would it not be factual to amplify the above statement by adding: "We have reason to believe that 1/2 sediment budget is a realistic figure to work with at this time. Accordingly, we have indicated our preference for a dam which will trap 299 mcy of sediment. We recognize that 299 mcy is below the 1/2-budget level where dredging from stabilization basins is less costly than building a retention dam. If 1985 studies confirm the decline of sedimentation, we obviously must give consideration to 338."

24. Feasibility Report says on page VII-3: "--- fish and wildlife impacts associated with a single retention structure need weighting against the downstream benefits attributable to such a structure."

This is a harsh over-simplification of one of the negative aspects of the proposed project. Those who are concerned about the fish and wildlife resources whose loss will be attributable to the dam will be quick to point out that environmental losses will be very real while downstream benefits will be largely theoretical. The statement would have been more palatable if it had said: "--- fish and wildlife impacts associated with a sediment dam in the Toutle River valley can be foreseen and estimated with fair certainty. Comparing these predictable losses against the list of downstream benefits, which are generally hypothetical, can quickly become an emotional confrontation. We shall refrain from taking sides in this trade-off argument until we have a better evaluation of the probabilities involved."

25. Feasibility Report says on page IX-1: "Material eroding from this avalanche --- is reducing flood protection levels in downstream urban areas ---." Having asserted that flood protection is declining because of sedimentation in the rivers, F. Report goes on to say: "Dredging is accomplishing the interim (100-year) flood protection authorized by PL 98-63, enacted in 1983."

It is possible to read these passages as saying: "We need a dam, but we don't need a dam." A more realistic statement might have gone something like this: "Material eroding from the avalanche moves downstream, some of it passing through to the ocean and the remainder depositing in the river channels. The sediment deposits, if not removed, could eventually create a flooding possibility for downstream urban areas. An active dredging program, however, has had no difficulty in removing the infill and maintaining the 100-year flood protection authorized by PL 98-63."

26. Feasibility Report says on page IX-2: "An SRS at the Green River site would create an impoundment of 3,267 acres."

Size of the impoundment is grossly underestimated since the acreage is actually about 4,100 acres. The statement, in the interest of accuracy, should say: "An SRS at the Green River site would create an impoundment of about 4,100 acres. An additional 3,373 acres of land outside the impoundment area will be needed for __________ purposes. This additional acreage is hillside, timber-growing land and, as it is not actually required for the proposed sediment-dam project, we presume that the owner, Cowlitz County's largest industrial employer, will resist giving it up."

Conclusion

The Corps of Engineers has a timetable for building a sediment dam in the Toutle River valley. Anyone who is thoroughly familiar with the Mt. St. Helens/Toutle River country cannot read the Feasibility Report without realizing that it strives to bolster the very weak justification for the dam. This paper points out some of the more conspicuous flaws in the arguments.

It is suggested that the Corps put its timetable on Hold until the erosion data base is up to date and the nature of the sedimentation problem is fully understood. A written acknowledgment and reply to this suggestion is requested.

Alden H. Jones

Alden H. Jones
130 Jones Road
Kelso, WA 98626
Phone - 206 423 6626

RESPONSE TO ALDEN JONES

1. The statement in the draft is accurate. The plan presented in the Feasibility Report is a refinement of the Comprehensive Plan. Work performed during continued planning and engineering (CP&E) will be a refinement of the Feasibility Report plan. As the system adjusts appropriate refinements will be made.

2. This report utilizes the formulation process developed in the Comprehensive Plan (see Appendix A). It also contains the sensitivity analysis presented in the plan (see Appendix B) which shows the single retention structure as the least costly solution to the sediment problem. The revised sediment projections discussed in this report fall partly within the partly below the ranges of total sediment volume and annual sediment rates presented in the Comprehensive Plan. This is due to our findings of reduced observed erosion. In the Comprehensive Plan, a total sediment range of 400 mcy to 2 bcy was discussed; in the Feasibility Report a range of 325 mcy to 975 mcy is discussed. In the Comprehensive Plan, an annual range of 30 mcy to 70 mcy was discussed; in the Feasibility Report, various ranges were discussed and an initial annual rate of 28 mcy was chosen. A discussion of the impacts of the new sediment budget on the sensivity analysis contained in the Comprehensive Plan follows in Chapter II.[1]

3. Comment is addressed in changed paragraph for page I-4 of Feasibility Report, as shown in 2. above.

4. In developing a permanent solution to the sediment problem, it became necessary to incorporate new information developed since completion of the Comprehensive Plan. These new data revised the projections on sediment movement and deposition. The major problems remain the increase in potential flooding to communities along the Cowlitz River, potential impacts due to interruption of the transportation corridor crossing the Toutle River, and potential disruption of navigation on the Columbia River.

---

[1]Underlined text reflects changes in main report.

5. Statement in report modified to reflect suggested changes.

6. The information available at this time does not support a drop in sediment yields to below 400 mcy. Sedimentation studies will continue during CP&E and new information will be evaluated as it becomes available. Every effort will be made to include WY 1985 data in the CP&E sediment forecast (see response to comment 7).

7. Table I-3 shows only the results that were developed during the Comprehensive Study, and has been included only to show part of the background used in the evaluation of the answers presented in the Feasibility Report.

8. The uncertainties associated with the sediment budget developed for this report, as well as that for the Comprehensive Plan, have been dealt with by performing sensitivity analyses on proposed management alternatives. Monitoring and refinement will continue during the design phase to incorporate the most up-to-date sediment information available. The sediment budget used in this report is based on observed erosion and sediment movement from the debris avalanche in the Toutle-Cowlitz system during the past 4 year. Data available included Cowlitz-Toutle suspended sediment data through September 30, 1983, Cowlitz-Toutle River cross sections through April 1984, U.S. Geological Survey debris avalanche cross sections through early 1984 and debris avalanche backhoe soil samples from May 1984. Projections for future erosion and sedimentation are based on these observations and the average hydrology of the past 50 years. The largest storm during the past 4 years had approximately a 10-year occurence frequency. While there has been no extremem post-eruption storm event, Spirit Lake has experienced several intense rain storms. Monthly rainfall in November 1983 was 229 percent of normal, including an intense 3.3 inches on one day. It is expected that large quantities of material will erode with extreme events (100-year and above) or as a result of volcanic or hydrologic events. Although no historical basis exists for raising the current sediment budget, sediment ranges on the high side have been considered in evaluating alternatives to cope with future special events.

9. Statement does not imply that problems associated with projecting future

sediment yields have been overcome. It recognizes that there are uncertainties and we have dealt with these uncertainties by performing sensitivity analyses on proposed management alternatives.

10. Same response as comment 8.

11. Variations in rainfall and runoff account for most of the variation in sediment yields during the past 3 years. The water discharge versus sediment discharge relationships at the U.S. Geological Survey stream gages do not indicate a decline in suspended sediment rate during the WY 1981-83 period. This issue will be reviewed again during CP&E.

12. At the time the Comprehensive Plan was prepared our best estimates placed the average annual erosion at 50 mcy/year during WYs 1981 and 1982. Improvements in the methods use and cross section data available resulted in the reductions presented in the Feasibility Report. We are again improving our methods and increasing our database during the CP&E sedimentation study and will make appropriate adjustments if needed.

13. Appropriate modification made.

14. Statement was revised to say "... single retention structure (SRS) is generally the least costly solution to the sediment problem within the total sediment yield range of 400 mcy to 2 bcy."

15. The statement in the Feasibility Report is correct. Provisions for flood events and mudflows must be considered during plan formulation.

16. Staement in report modified to reflect suggested changes.

17. Statement is correct based on existing data. The sediment forecasts will be re-evaluated during CP&E, but it is too early to speculate on the outcome.

18. Statement in report modified to reference extent of fish passage facilities in Section V.

19. Of the alternatives analyzed, the preferred plan would cause the least disruption of the physical environment and related resources. This statement is substantiated by resource agencies. Specific impacts are more fully discussed in the environmental impact statement.

20. The "750 mcy over the next 50 years" should read "650 mcy over the next 50 years."

21. See response to comment 17.

22. The positive impacts of the preferred plan on the regional economy has been acknowledged by the County, affected ports, and individuals. The statement in the Feasibility Report appears adequate.

23. The 1/2E budget was used during the sensitivity analysis to show cost impacts that would occur if annual sediment yield was less than that selected for design purposes. This should not be constured as a lack of confidence in the selected sediment yield based on existing data.

24. The U.S. Fish and Wildlife Service has evaluated impacts to the resource above and below the structure. They have not indicated that downstream benefits are any more theoretical than the upstream losses. They acknowledge both benefits and losses will occur and both are difficult to quantify.

25. Statement in report modified to reflect suggested changes for clarification.

26. A SRS at the Green River site would impound 299 mcy of sediment covering 3,267 surface acres during the 50-year project life. Ultimately 411 mcy of sediment would be trapped over 4,100 surface acres. Total project lands at the SRS site would total 7,470 acres.

Longview Washington
Dec 12 1984

Dist. Engineer;
Dear Sir

Our County Commissioner; Chamber of Commerce & Service Clubs are asking the citizens to write to you in favor of your corps to build a high dam on upper Toutle River.

I am one citizen who opposes any kind of a dam on Toutle River.

A number of years ago; I as a voter along with the majority of the voters of the state of Washington passed a law stating no more dams over twenty five feet high was to be build on any stream that flowed into Columbia River below Bonneville Dam.

I hope you take that into consideration before you go against the voters of Washington State

Yours truly
Albert J Wiest

Response to Albert Weiss' Comments:

Thank you for bringing this issue to our attention. We have conveyed your concern to State of Washington officials.

Section 2: Comments without Specific Responses.
A summarization of these comments and our responses to them are found in the introduction to this exhibit.

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

Western Direct Federal Division
610 East Fifth Street
Vancouver, Washington 98661-3893

NOV 15 1984

IN REPLY REFER TO
HDF-17.121

Jon D. Katin, Lt. Col.
Acting District Engineer
Portland District, Corps of Engineers
P. O. Box 2946
Portland, Oregon 97208-2946

Your Reference: Planning Division (NPPPL-AP)

Dear Col. Katin:

Washington FH Route 15, Mt. St. Helens Highway
Draft - Volume 1 - Main Report
Mt. St. Helens, Washington - Feasibility Report

Since the May 18, 1980, eruption of Mt. St. Helens, the Western Direct Federal Division of the Federal Highway Administration has assisted the Forest Service with the repair and reconstruction of 187 miles of roadway in the disaster area costing in excess of $27,000,000. Your proposal does not affect these Forest Development Roads and we have no preference to any sediment control alternative being considered.

It should be noted that SR 504 is a designated Forest Highway Route from I-5 to Coldwater Lake and, therefore, is eligible for Forest Highway funding as well as emergency relief monies referred to in Chapter X. We are not aware of any plans to use these very limited Forest Highway funds on SR 504, and any such use must be coordinated through the Gifford Pinchot Forest Engineer.

We also encourage your continued coordination with the Washington State Department of Transportation for any developments affecting SR 504.

We appreciate the opportunity to review the draft. Please feel free to contact us if you have questions.

Sincerely yours,

Glen Bedell for
James N. Hall
Division Engineer

Cowlitz County

BOARD OF COUNTY COMMISSIONERS
WALTER CHURCH JR. DISTRICT NO. 1
BERYL ROBISON DISTRICT NO. 2
VAN A. YOUNGQUIST DISTRICT NO. 3

December 10, 1984

Colonel Robert Friedenwald, District Engineer
U. S. Army Corps of Engineers
Post Office Box 2946
Portland, Oregon 97208

Re: Comments on Mount St. Helens Feasibility Report

Dear Colonel Friedenwald:

The Board of Commissioners believes the Mount St. Helens Feasibilty Report and the Draft Environmental Impact Statement are a thorough analysis of the sediment retention solution alternatives and the associated impacts. Three of our major comments on the Report are contained in the attached community consensus position statement. We heartily endorse the following three consensus points and rationale:

1. Implement a permanent sediment retention solution as soon as possible.

2. Recommend the preferred plan, a 177-foot structure at the Green River site, downstream dredging and some levee reinforcement to the Administration and Congress.

3. Avoid requiring local governments to participate in funding this project.

In addition to supporting the consensus position, we would like to submit the following comments.

<u>Timing of Implementation</u>

For the past 4-1/2 years, we have advocated implementation of a permanent sediment retention solution as quickly as possible. We are now entering the fifth winter since the eruption. With each storm, we wonder how much longer our good fortune of no flooding will continue. Pages II - 1 & 2 of the Report speak to one of our gravest concerns.

> "The largest storm during the past 4 years had less than a 10-year occurrence frequency. It is expected that large quantities of material will erode from extreme events or as a result of mudflows from volcanic or hydrologic events."

By relying on interim dredging, we are risking substantial damages from large storms or back-to-back storms. There simply may not be time or suitable conditions to dredge the Cowlitz River during the winter. We need preventive action rather than reactive measures, and we need it as soon as possible.

207 FOURTH AVE. NORTH • KELSO, WASHINGTON • 98626 • TELEPHONE (206) 577-3020 SCAN 562-3020

The dismal economic picture in Cowlitz County has been compounded by uncertainty in river conditions. Business expansions have been curtailed and new businesses are locating in adjacent counties. Unemployment rates remain double digit month after month. We desperately need to stabilize and expand our economic base if we stand any chance of recovering from the recession. A number of other decisions are contingent on selection and implementation of a permanent sediment solution. The Department of Transportation cannot finalize the alignment of SR 504 until a decision on the retention structure is reached. DOT is prepared to rebuild the highway to Elk Rock by the time 1986 Expo opens in Vancouver, B.C. as soon as the final alignment decision is made.

Construction of a 177-foot sediment retention structure at the Green River Site **as soon as possible** is a critical component for improving our economic climate, restoring services and alleviating fears and anxiety among our residents.

<u>**Fish and Wildlife Mitigation**</u>

We have had the opportunity to review several drafts of the fish and wildlife mitigation report. The Fish and Wildlife Service kindly sent us the final draft Fish and Wildlife Coordination Act Report on November 23, 1984.

The issue of fish and wildlife mitigation has been difficult for us to resolve as we recognize that pre-eruption fish and wildlife resources were of significant value socially and economically to the local area. Especially since we are attempting to diversify our economic base by promoting tourism, we would like to see these resources recover to the fullest extent possible.

However we are keenly aware of the comments made to us by Mr. Don Craybill and Mr. Don Cluff, both OMB officials, in a June 20, 1984 meeting. They made it very clear that the Administration would support authorization and appropriations for a permanent sediment control solution only if it was not a "fish and wildlife Christmas tree", only if expensive mitigation plans were not required.

Neither Exhibit 1 in the Feasibility Report nor the final draft of the Coordination Act Report give us any idea of the total cost. This is of particular concern since page VII-4 of the Feasibility Report recommends that all fish and wildlife costs beyond construction of a fish by-pass facility be made a non-federal obligation.

We do not want fish and wildlife mitigation so expensive or so open-ended that it prices the federal government out of this project. We cannot possibly afford to provide compensation for the eight Columbia River sites identified in the final draft Coordination Act Report. Hundreds of acres of land would need to be purchased to achieve zero net loss of habitat. It is totally beyond the resources of local governments to even consider such a proposal. We believe that OMB would consider this a "fish and wildlife Christmas tree" if such a request was made for federal funding.

We are also concerned about the impact on private lands of one of the final draft Coordination Act Toutle River recommendations. It requests temporary cessation of timber harvest along the Green River, North Fork Toutle River and upper Hoffstadt Creek. We believe that private landowners will maintain strong opposition to any timber harvest restrictions on their lands. The potential for this kind of controversy could easily delay the project.

It should be made clear that Cowlitz County is not trying to kill fish and wildlife mitigation. We support mitigation measures that are reasonable, accomplishable, affordable and will not delay the project. We are in total agreement with your general response on Page 1 of Exhibit 1. Mitigation should only be for those impacts caused by the sediment retention structure, and not from the eruption. The mitigation proposed in your Report is reasonable, and local governments in Cowlitz County cannot afford to pay for more.

Cost-Share - Land Acquisition

The County's position on cost-share is expressed in the community consensus position. Our inability to participate in funding the SRS project has been made more clear these past few weeks as we complete the 1985 County budget. Revenues are down. Deep cuts in many operational programs are necessary to keep the County solvent. We do not anticipate that our financial situation will improve in the immediate future. Therefore we simply cannot afford to cost-share this project.

Regardless of who pays for acquisition of lands, easements and rights-of-way for construction and maintenance of the project, the federal government should handle the acquisition process. We do not have the resources or expertise to accomplish a project. State condemnation laws would force project delays from nine months to one year. Only the Corps of Engineers has the capability of acquiring all the necessary lands **without delay.**

We realize that some of the above points are redundant of earlier County comments. They are no less important today. Indeed, as the final decision draws nearer we are more concerned than ever that the best interests of all our citizens are protected.

Thank you.

BOARD OF COUNTY COMMISSIONERS
OF COWLITZ COUNTY, WASHINGTON

Van A. Youngquist

Van A. Youngquist, Chairman

Walter Church

Walter Church, Jr., Commissioner

Beryl Robison

Beryl Robison, Commissioner

Enc.

Cowlitz County

BOARD OF COUNTY COMMISSIONERS
Walter Church Jr. DISTRICT NO 1
Beryl Robison DISTRICT NO 2
Van Youngquist DISTRICT NO 3

DEPARTMENT OF COMMUNITY DEVELOPMENT

PHYSICAL PLANNING • CODE ENFORCEMENT

207 FOURTH AVENUE NORTH • KELSO, WASHINGTON 98626 • TELEPHONE (206) 577-3052

SUMMARY OF LOCAL GOVERNMENT EXPENDITURES AS A RESULT OF THE MOUNT ST. HELENS ERUPTION DECEMBER 1984

Cowlitz County	$ 3,133,400
City of Longview	531,816
City of Kelso	234,589
City of Castle Rock	947,791
City of Woodland	905
Cowlitz-Wahkiakum Governmental Conference	18,813
Cowlitz-Wahkiakum Health District	64,154
Longview School District	75,481
Kelso School District	5,712
Woodland School District	9,672
Beacon Hill Sewer District	20,535
Longview Diking Improvement District	161,550
South Kelso Diking Improvement District	837,920
North Kelso Drainage Improvement District	108,560
Lexington Flood Control Zone District	558,470
Port of Longview	91,241
Port of Kalama	141,565
Cowlitz County P.U.D.	424,373
Kelso Housing Authority	455
TOTAL:	$ 7,367,002

Source: Individual contact with each agency.

COWLITZ-WAHKIAKUM GOVERNMENTAL CONFERENCE

COWLITZ COUNTY ADMINISTRATION ANNEX
207 - 4TH AVE. N.
KELSO, WASHINGTON 98626
PHONE (206) 577-3041
SCAN - 562-3041

COWLITZ COUNTY
CITY OF LONGVIEW
CITY OF KELSO
CITY OF CASTLE ROCK
CITY OF WOODLAND
CITY OF KALAMA
TOWN OF CATHLAMET
PORT OF LONGVIEW
PORT OF KALAMA
COWLITZ COUNTY P.U.D. NO. 1
LONGVIEW SCHOOL DISTRICT NO. 122
KELSO SCHOOL DISTRICT NO. 453
BEACON HILL SEWER DISTRICT
WAHKIAKUM COUNTY PORT DISTRICT NO. 2
WAHKIAKUM COUNTY

December 13, 1984

Colonel Robert Friedenwald
District Engineer
U.S. Army Corps of Engineers
Portland, OR 97208

RE: Cowlitz-Wahkiakum Governmental Conference Position on Actions for the Long-Term Recovery from Mount St. Helens

Dear Colonel Friedenwald:

The Cowlitz-Wahkiakum Governmental Conference, a voluntary organization of seventeen general and special purpose governments, held a special meeting on December 6 to discuss the Corps' Mount St. Helens Feasibility Report and Draft Environmental Impact Statement. As a result of that meeting, the Governmental Conference supports the following positions addressed in that report.

1. <u>Measures to eliminate the risk created by sediment movement should be implemented as soon as possible</u>.

The Corps' report accurately and comprehensively describes the social and economic impacts to this area resulting from the persistent uncertainty about risks of flooding and volcanic activity. Severe stress has caused some local residents to leave the area. Investment strategies have changed. Business relocation and expansion decisions have been delayed, preventing this region from participating in the economic growth enjoyed by the rest of the country.

We urge you to approve and implement permanent solutions to the sediment in-fill problems as soon as possible. Reduced flood hazards would relieve anxiety among our residents, improve the climate for business and investment, strengthen the area's economic base, and enhance our quality of life.

2. <u>The preferred plan, a 177-foot structure at the Green River site, downstream dredging and level reinforcement, is the best alternative solution</u>.

The preferred plan offers the greatest benefits for the lowest cost. The retention structure will store most of the material projected to erode from the debris avalanche to the Cowlitz and Columbia Rivers. It also has the capability of protecting the downstream communities, Castle Rock, Lexington, Longview and Kelso, by containing or reducing the design mudflow or the runoff from a 100-year storm. Because the plan combines dredging with a retention structure, it is the most adaptable to changing conditions in the Toutle River drainage basin. The plan would involve acquisition of the fewest number of individual parcels and occupied homes. It would also have the least impact on fish, wildlife and their habitats.

3. <u>Although the Feasibility Report recommends non-federal cost sharing for this project, we view mandatory participation by local governments in the funding arrangement unfavorably.</u>

The benefits from the preferred plan are not only regional, but also national in scope. The economies of Montana, Idaho, Oregon, and Washington are affected by the Columbia River navigation channel. Twenty percent of all foreign trade on the West Coast passes through the Lower Columbia River. The only railroad link between Portland and the Puget Sound Area crosses the Toutle River; in 1983, the Union Pacific and Burlington Northern Railroads carried 57 million tons of freight between those two markets. Interstate 5 connects the three West Coast states with Canada and Mexico. Over 11 million vehicles crossed the I-5 Toutle River bridge in 1983. It is of paramount importance to protect these facilities so that interstate and international commerce and transportation can be at least maintained, if not improved. All costs from projects, such as the preferred plan, which have such wide reaching impacts and benefits, are traditionally borne by the Federal government.

Finally, as mentioned earlier, the economic recovery experienced by the rest of the nation has not occurred here. Unemployment rates are consistently at least five percentage points higher than the national average. Because of the depressed local economy, it would be nearly impossible to generate the $17 million local share of this project. Moreover, if the project is not implemented, even more federal disaster relief funds will be needed in this area.

Colonel Robert Friedenwald
December 12, 1984
Page 3

Thank you for the opportunity to comment on the Corps' report. We trust you to consider seriously these points as you develop your final recommendation to the Administration.

Very truly yours,

Floyd V. Carpenter

Floyd Carpenter
Chairman

FC:SU:hmb

CITY of CASTLE ROCK

P.O. Box 370 Telephone 274-8181
CASTLE ROCK, WASHINGTON 98611

November 27, 1984

District Engineer
U. S. Army Engineer District, Portland
Attn: NPPPL-AP
Post Office Box 2946
Portland, Oregon 97208

Dear Colonel Friedenwald:

At a regular meeting of the Castle Rock City Council held November 26, 1984, the City Council unanimously voted to express our support for the following positions on issues outlined in the Corp's Mount St. Helens Feasibility Report:

1. Implementation of permanent steps to eliminate danger created by sediment movement as soon as possible.

2. Construction of a 177-foot structure at the Green River site, downstream dredging and some levee reinforcement.

Due to our current deficit caused by the Mount St. Helens disaster, we strongly urge 100% Federal funding of this project.

Please include this letter in the Public Hearing record.

Sincerely yours,

Michael D Huson

Michael D. Huson
Mayor

MDH/pb

DENNIS P. WEBER MAYOR

THE CITY OF LONGVIEW

FOUNDED 1923

LONGVIEW, WASHINGTON 98632

December 4, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, OR 97208

Dear Colonel Friedenwald:

RE: POSITION FOR LONG TERM
MT. ST. HELENS RECOVERY

The Longview City Council would like to express its support for the following position on issues addressed in the U.S. Corps of Engineers Feasibility Study of Mt. St. Helens.

1. *A permanent solution should be implemented as soon as possible to eliminate the risk created by sediment movement down the Toutle and Cowlitz Rivers.*

   The City of Longview is experiencing major social and economic adversities resulting from the uncertainity about the risk of flooding and volcanic activity. The Corps of Engineers report is quite accurate in describing the impact to Longview and its residents. Community anxiety is heightened by the knowledge that a solution to the problem is neither simple nor likely to be implemented without delay.

   A permanent long term solution once approved and implemented, would reduce flood hazards and restore normal social and economic conditions as well as improve the climate for investment and business. Long range planning and investment strategies by businesses who could relocate within the area are being unreasonably delayed. The unemployment rate within the City and Cowlitz County have continued in double digit percentage figures since September, 1980. The current unemployment rate is approximately 11%.

   We support and urge you to approve and implement a permanent solution to the sediment problem and restore this community to its pre-Mt. St. Helens eruption position as soon as possible.

2. *The City of Longview endorses and supports the preferred plan of the Corp of Engineers, to install a 177 foot structure at the Green River site, with downstream dredging and some levy reinforcement.*

   Such a structure provides the greatest benefit at the lowest cost. It has the physical capability to store most of the material projected to erode from the debris avalanche, much of which will be deposited in the Cowlitz and Columbia Rivers over the fifty year projected life. Building the structure in one stage is the most cost effective solution. The structure as proposed has the capacity to contain and/or reduce peak flows from a design mud flow of 75 million cubic yards per year. This can be accomplished without worsening conditions at the structure site or damage to the cities downstream. The structure as proposed, will impact the fewest number of property owners and occupied homes within the area.

   Of vital importance is the least negative impact that this proposal will have on fish and wildlife. Fish migratory paths to the south fork Toutle and Green River system will remain open. The bypass facilities proposed in this preferred plan will allow fish access above the structure in the north fork of the Toutle River. Reduction of sediment below the structure will provide some spawning and rearing habitat in the main stream of the Toutle River.

The Longview City Council would like to go on record in support of the quickest possible implementation of the preferred plan as proposed.

Sincerely,

CITY OF LONGVIEW

Dennis P. Weber

Dennis P. Weber
Mayor

DPW:JWB/ls

December 17, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208

Re: Community Consensus Position #2 for Long-Term
Mount St. Helens Recovery

Dear Colonel Friedenwald:

We, the undersigned representatives of local governments, service and civic organizations, express our support for the following positions on issues addressed in the Corps' Mount St. Helens Feasibility Report. Please include this letter in the public hearing record.

1. **We request that permanent measures to eliminate the risk created by sediment movement be implemented as soon as possible.**

   Our communities are experiencing the major social and economic effects that persistent uncertainty about risks of flooding and volcanic activity brings to an area. Your report is very accurate in describing the impacts to our communities and residents. Some individuals are showing symptoms of severe stress. Community concerns are intensified by the knowledge that solutions are neither simple nor likely to be implemented without some delay. Some residents have chosen to leave the area.

   Since long-range planning is impossible, investment strategies have changed and business relocation and expansion decisions are being delayed. Unemployment rates in Cowlitz County have been double digit every month since September 1980. The rate peaked at 20.5% in November 1982, but has been 15.2%, 14.5%, 13.3%, 13.7%, 12.6%, 12.2%, 12.5%, 12.1%, 11% and 12.1% the first ten months this year.

   Even though interim authorization, PL 98-63, requires that 100-year flood protection be maintained for urban areas along the Cowlitz River, your report indicates there is still the risk of $7.1 million residual average annual damages. The longer we must continue to rely on interim protection, the greater is the likelihood that these damages will be suffered.

   With a long-term permanent solution approved and implemented, reduced flood hazards would restore normal social and economic conditions and improve the climate for business and investment. Anxiety and uncertainty would be reduced among our residents. The underlying economic base would be strengthened and the quality of life enhanced. We urge you to approve and implement permanent solutions to the sediment infill problems as soon as possible.

2. **We support the preferred plan, a 177-foot structure at the Green River site, downstream dredging and some levee reinforcement, for the following reasons:**

   a. It provides the greatest benefits for the lowest cost according to current data.

   b. It has the physical capability to store most of the material projected to erode off the debris avalanche and reach the Cowlitz and Columbia Rivers over the 50-year project life. Even if the projections on the amount of sediment erosion decrease in the future, we want a structure this size to handle extreme events. Available analyses indicate that construction in one stage is the most cost effective solution. However, we support continued sediment budget and sensitivity analyses to ensure final selection of the safest permanent design for implementation.

   c. It has the capacity to contain or reduce peak flows from a design mudflow (75 mcy) or a 100-year storm event. This can be done without worsening conditions at the structure site or at downstream damage centers (Castle Rock, Lexington, Longview and Kelso).

   d. It offers maximum flexibility to respond to changing conditions in the unstable Toutle River basin by combining a retention structure with some downstream dredging. It allows downstream dredging activity to increase at given locations if necessary depending on weather conditions. This is important since the current Cowlitz River levees can not be raised further without rebuilding the entire structure. Ground water levels in areas behind the levees have been rising as the river bottom infills. The ability to address these problems in the future must be retained in the preferred plan.

   e. It impacts the fewest number of property owners and occupied residences. Only 9 occupied residences out of 24 ownerships would be impacted compared to 13 occupied residences out of 73 ownerships at LT-3 and 34 occupied residences out of 94 ownerships at Kid Valley.

   f. It has the least impacts on fish and wildlife. Fish migratory paths to the South Fork Toutle and Green River system remain open. The by-pass facility proposed in the preferred plan allows fish access above the structure in the North Fork Toutle River. As sediment is trapped behind the structure, downstream riverbeds and channels will stabilize and turbidity will decrease. Reduction of sediment below the structure will provide some spawning and rearing habitat in the main stem Toutle River. As the channel stabilizes, quicker re-establishment of riparian vegetation will occur.

3. **Non-Federal cost sharing is recommended in the Feasibility Report. We understand the basic concept of non-Federal cost sharing. However, for the following reasons we believe that local governments (e.g., counties, cities, and districts, etc.) should not be required to participate in funding this project:**

   a. The sediment structure is a permanent solution to a unique major disaster. Even with the structure, local governments will continue to respond to site specific, eruption-caused problems that do not qualify for federal funding. Since 1980, local governments in Cowlitz County have spent over $7 million on recovery measures that were not covered by federal programs. Examples of on-going expenditures include increased water system and diking district maintenance, additional road stability repairs, spoils site rehabilitation and other activities. This has and will continue to tax our financial viability. We simply cannot afford to cost share in the sediment structure while solving the many other related disaster recovery problems for which federal assistance is not available.

   b. The sediment structure has regional if not national benefits. The Columbia River navigation channel is a major transportation facility that impacts the economy of Oregon, Idaho and Montana as well as Washington. In 1983, Oregon and lower Columbia River ports handled approximately 26% of all foreign trade conducted on the West Coast according to Corps of Engineers figures. More significantly this same region, which relies on the portion of the Columbia River impacted by Mount St. Helens, accounted for 37% of the export volume on the West Coast. The exports are primarily agricultural and commodity in nature bound for Pacific Rim markets. This is a significant contribution to solving the nation's balance of trade problems as well as assisting the agricultural community.

   Interstate-5 and the Burlington Northern-Union Pacific -Amtrak rail line are vital land transportation links on the West Coast. In 1983, the I-5 average daily traffic count in both the north- and south-bound lanes at the Toutle River Bridge was 31,000 or 11,315,000 trips for the year. The Burlington Northern and Union Pacific Railroads moved approximately 57,000,000 tons of freight across the Toutle River railroad bridge in 1983. This means 27-36 trains per day including 6 Amtrak trains. This represents 100% of the train traffic between Puget Sound and Portland as this is the only north-south rail line between these two areas. The tracks must remain open to facilitate export grain movement from Puget Sound and Portland on down the West Coast. Costs to reroute that traffic across the Cascade Mountains to Spokane and down the Columbia River are astronomical.

   Protecting all of these facilities is vital for interstate commerce and transportation. Traditionally the Federal government has paid all costs for projects having these kinds of regional and national benefits.

   c. The source of the problem is located on Federal land. Within the North Fork Toutle River drainage basin, 44,400 acres are owned by the Federal government. That constitutes nearly all of the eruption impact area that is causing our problem. It is grossly unfair to ask local governments to pay any part of a problem that originates on Federal land.

   Even though the rest of the country is apparently recovering from the recession, the recovery seems to have by-passed this State and especially Cowlitz County. Mount St. Helens recovery problems and economic problems have resulted in the high unemployment figures noted earlier. Many jobs have been lost in the forest products industries because of the loss in land base from the eruption devastation, reduced timber supply, export competition and shifts in market. Given the high unemployment rate, it is unfair to ask local governments to financially contribute to a sediment solution that originates on federal land and has national benefits.

   d. The Federal government is eminently more capable of acquiring lands, easements and rights-of-way for this magnitude of project than local government. The Corps has a larger, more experienced real estate staff than any State or local agency. State condemnation laws would force project delays from nine months to one year. Since this project must be implemented as soon as possible, land acquisition must be handled as quickly as possible. Only the Federal government can accomplish the real estate transactions quickly enough to keep implementation on an acceptable schedule.

   e. Administration officials have previously acknowledged the uniqueness of this disaster and the need for equity in financing a solution.

   - July 16, 1981 testimony before Senate Subcommittee on Water Resources of the Committee on Environment and Public Works:

     SENATOR GORTON: "Under your (100 percent federal cost recovery) proposals, in the event of a natural disaster of immense magnitude, obviously, I am referring to the eruption of Mount St. Helens, where literally millions of tons of material was put into the shipping channels overnight, the removal of which will require a number of years, would you expect the local entities to be responsible for recovering the cost of restoring a channel under your O & M proposals to its previous condition?..."

DAVID STOCKMAN: "I think you would want to make a distinction in the case of a rare and major catastrophe that isn't part of the normal cycle of siltation and development of other impediments to navigation. So I don't think that we would apply those unique and one-time costs to our concept of user recovery."

- June 9, 1982 letter from William Gianelli, Assistant Secretary of the Army for Civil Works, to the Cowlitz County Board of Commissioners:

  "As a result of the meeting and follow-up actions, the President on May 18, 1982, directed the Secretary of Defense to have the Corps of Engineers prepare a comprehensive plan to deal with the long-term threat caused by the existing volcanic debris and sediment. .... The study will identify the most appropriate management measures in light of benefits and resources required to achieve these benefits, as well as the division of responsibility for implementation and funding of individual measures between Federal, State and local entities."

- January 16, 1984 letter from Assistant Secretary Gianelli to Governor Spellman:

  "We are also in agreement that the Administration's proposed cost sharing (65% Federal - 35% non-Federal) policy for water projects in general is not appropriate for this problem. The tables presented in the document were intended only to illustrate parameters in the cost sharing negotiation process. Ultimately, depending on the solution chosen, there will need to be some sharing of costs among the various parties. Both the Federal government as well as the State and local governments will need to be involved in any arrangements which are finally worked out."

- January 24, 1984 letter from President Reagan to Senator Laxalt, Chairman of Appropriations Subcommittee on Commerce, Justice, State and Judiciary:

  "All Federal water development agencies will continue to seek out new partnership arrangements with the States and other non-Federal interests in the financing and cost sharing of all proposed projects. Each such agency will negotiate reasonable financing arrangements for every project within its respective area of responsibility."

"Prior commitments to individual States with regard to water development within their borders must be considered and shall be a factor in negotiations leading up to project construction."

"Consistency in cost sharing for individual project purposes, with attendant equity, will be sought."

Thank you for the opportunity to comment on this report. We ask you to give the above points serious consideration when you reach the final recommendation that will be forwarded to Washington, D.C.

Cities, County, and Regional Government

Van A. Youngquist, Chairman
Cowlitz County
Board of Commissioners

John S. McKibbin, Chairman
Clark County Commissioners

Luther L. Peek, Chairman
Wahkiakum County Commissioners

John T. DeFrance, Director
Emergency Services for
Board of Commissioners,
Columbia County, Oregon

Dennis P. Weber, Mayor
City of Longview

Richard I. Woods, Mayor
City of Kelso

Michael D. Huson, Mayor
City of Castle Rock

R. L. Maruhn, Mayor
City of Kalama

W. K. Mills, Mayor
City of Woodland

Melvin Irving, Mayor
Town of Cathlamet

Floyd V. Carpenter, Chairman
Cowlitz-Wahkaikum Governmental
Conference

William V. Benson, Chairman
Skamania County
Board of Commissioners

Service Districts

Karen P. Pickett, President
Cowlitz Economic Development
Council

Robert L. McKinney
General Manager
Public Utility District No. 1
of Cowlitz County

Robert G. Guide, President
Longview School District
Board of Directors

Edwin F. Rutherford, President
Beacon Hill Sewer District
Board of Commissioners

Donald C. Maahs, President
Kelso School District
Board of Directors

Ernest S. Parrott, Chairman
Consolidated Diking
Improvement District No. 3
(South Kelso)

Jan D. Gano, Chairman
Castle Rock School District
Board of Directors

Wayne Daigle, Engineer
Consolidated Diking
Improvement District No. 2
(Woodland)

Mal Swanson, Superintendent
Kalama School District

Ports

Lloyd Anderson
Executive Director
Port of Portland

Larry M. Larson, President
Port of Longview
Board of Commissioners

John W. Fratt, Manager
Port of Kalama

Everett Groves, Chairman
Wahkiakum Port District No. 2

Peggy Bird, Executive Director
Pacific Northwest Waterways
Association

Charles R. Miller
Assistant to the Director
Port of Vancouver, U.S.A.

Unions

Vern Adams, Representative
Southern Washington Area
Association of Western
Pulp & Paper Workers

James R. Herron, President
International Longshoremen's
and Warehousemen's Union
Local #21

Richard D. Powell
Advisory Board Chairman
United Food and Commercial
Workers, Local #367

Harold B. McCorkle
Financial Secretary Business
Representative
Carpenters Union Local #1707

Laythell J. Bales
Secretary-Treasurer
Teamster's Local #58

Political Organizations

David V. Creel, Chairman
Cowlitz County Republican
Central Committee

Dean A. Takko, Chairman
Cowlitz County Democratic
Central Committee

Gordon W. Sondker, Acting
Chairman, Cowlitz County
Republican Men's Club

Todd Whitrock, President
Cowlitz County Democratic
Men's Club

Anna Niemi, President
Cowlitz County Republican
Women's Club

Civic Organizations

Karl Salzsieder, President
Longview Chamber of Commerce

Gay V. Selby, President
Kelso Chamber of Commerce

Chris Roubicek, President
Castle Rock Chamber of Commerce

Gloria L. Turner Rhodes
President
Kalama Chamber of Commerce

Kathi Wheeler, Chairperson
Yale/Cougar Community Council

Other Organizations

Mark W. Chilcote, President
Willapa Hills Audubon Society

CITY OF VANCOUVER, WASHINGTON
City Hall, 210 East 13th St. - P. O. Box 1995
Vancouver, Washington 98668-1995

December 14, 1984

Colonel Robert Friedenwald
District Engineer
Corp of Engineers
P.O. Box 2946
Portland, OR 97208

Re: Community Concensus Position #2 for Long-Term
Mount St. Helens Recovery

Dear Colonel Friedenwald:

The City of Vancouver supports the position statements dated December 17, 1984 submitted to you by the Cowlitz County Board of Commissioners and others.

Sincerely,

BRYCE SEIDL
Mayor

PORT OF KALAMA

KALAMA, WASHINGTON, 98625, U. S. A.
P. O. BOX 7
(206) 673-2325

December 17, 1984

Colonel Robert Friedenwald, District Engineer
U.S. Army Corps of Engineers
PO Box 2946
Portland, OR 97208

RE: Comments on Mount St. Helens Feasibility Report

Dear Colonel Friedenwald:

The Port of Kalama Board of Commissioners strongly supports the implementation of a permanent sediment retention solution as soon as possible and the construction of a single, 177-foot structure at the Green River site, downstream dredging and some levee reinforcement as recommended in the Corps of Engineers' Mt. St. Helens Feasibility Report. The Commission also endorses the policy to avoid requiring local governments to participate in funding this project.

In addition to supporting the comments of the Cowlitz County Community Consensus Position, we wish to note an additional item of concern--the significant costs of mitigation as requested by the U.S. Fish and Wildlife Service. While we realize that the pre-eruption fish and wildlife resources were of significant value socially and economically to the local area, we do not feel that local governments should be asked to support mitigation efforts for this eruption circumstance. Mitigation should only be for those impacts caused by the sediment retention structure. We believe the Corps' preferred plan has the fewest short- and long-term impacts to fish and wildlife of any of the alternatives considered. As a matter of fact, the Corps' EIS states that the single retention structure will accelerate recovery of downstream channels and habitat, providing fishery benefits. We believe the SRS is a significant mitigation measure in and of itself. Any mitigation in addition to this would be an unreasonable burden to place on the local entities.

Thank you for the opportunity to respond to this project plan.

Sincerely,

John Fratt
Manager

JF/clm

Port of Kalama, Where Highway, Rail and Water Meet.

Port Longview

December 10, 1984

Colonel Robert L. Friedenwald
District Engineer
Portland District, Corps of Engineers
Attention: NPPPL-AP
P. O. Box 2946
Portland OR 97208

Dear Colonel Friedenwald:

This position statement is presented on behalf of the Port of Longview Board of Commissioners in response to the Draft Mount St. Helens, Washington Feasibility Report & Environmental Impact Statement - Volume 1 - Main Report.

The Port's primary obligation and concern is to maintain navigation on the Columbia River and lower Cowlitz River. The port has signed a Resolution of Formal Assurances of Local Cooperation. To the extent that such undertaking is presently enforceable, the Port may be required to provide spoils disposal sites to maintain these channels. In the past has done so. The continuous and ongoing intrusion of sediment into these channels presents a major problem in furnishing sites. Also, due to severe depressed economic conditions in our local region (somewhat due to the eruption of Mount St. Helens and the ongoing volcanic action), the opportunity to develop spoiled lands economically places a premium on disposal sites. This matter is further compounded by mitigation for loss of wild life sanctuaries (wetlands) and loss of fish habitat.

If some method of sediment control is not put in place, the continuing maintenance of the navigation channels will become extremely expensive if not prohibitive.

This is aside from the fact that the lack of control places thousands of lives and millions of dollars of property in jeopardy.

The issue is not local nor even regional from the standpoint of economic impact. It is nationwide. The Columbia/Snake River watershed and its hinterlands are served not only by water transport but by interstate highway systems and primary rail carriers. Any interruption of the water transport system would result in all modes suffering severe economic loss and the ripple effect would be felt nationwide. Twenty percent of the West coast offshore trade is generated in the Columbia River port system. Of this 20 percent, 9 percent is import trade and 27 percent is export. This contributes significantly to a favorable balance of trade. This factor is also extremely important to the U. S. economy as one key industry is directly affected, AGRICULTURE.

Port Longview

The Port industry on the Columbia River has made sizeable investments in infrastructure to serve the offshore trade. The industry, as sponsors, has also made significant contributions in cooperation with the Federal government in developing and maintaining the waterway system.

Having cited the above circumstances, we adopt the following position:

1. Permanent sediment control by supporting the Preferred Plan for the 177-foot single retention structure at the Green River site with downstream actions, other miscellaneous actions and fish and wild life measures.

2. Reconsideration be given to the non-federal cost share as recommended by the feasibility report. The eruption of Mount St. Helens was a unique, one-of-a-kind disaster and its impact goes beyond local and regional boundaries.

We appreciate the opportunity to present our position. Please enter our letter in the record.

Respectfully submitted:
PORT LONGVIEW

BOARD OF COMMISSIONERS

Larry M. Larson
Ralph S. Holt
Lloyd V. Carpenter

POL/agm

PORT OF VANCOUVER USA

December 14, 1984

Col. Robert Friedenwald
District Engineer
Portland District U. S. Army Corp. of Engineers
P. O. Box 2946
Portland, Oregon 97208

Subject: Draft Feasibility Report and Environmental Impact Statement for Mt. St. Helens, Washington

Dear Col. Friedenwald,

Please refer to the Port of Vancouver U.S.A. response dated January 4, 1984 to "A comprehensive plan for responding to the long term threat created by the eruption of Mt. St. Helens, Washington".

We believe that the new draft feasibility report is a start to answer at least 2 of our 3 major concerns which were:

(1) Time/money - Now is the time -- no further studies are needed! Money cannot be the governing factor or we might be responsible for human lives, not just a 40' channel.

(2) Spirit Lake - A positive method of draining and reducing this level below the 3,440' elevation. The drainage must be maintained in the Toutle/Cowlitz Basin, the alternative to tunnel to Smith Creek into the Lewis River is not a good one. It would appear that conduits or open channel drains through any of the debris dams are not permanent solutions. Referring to the Figure VII-2 on Page VII-11 of the comp. plan we would recommend tunnels (F) or (G) - while more expensive, they might stand up better to eruptive or earthquake activity and above normal snow melt/rain/avalanche hazards normal in this area.

(3) Sediment Containment - This is a more complex problem but again another study and solutions because of cost are not the answer; in the best interest of life and navigation, a permanent containment plan and structure must begin as soon as possible. This control system should keep all sediment in the upper Toutle River Basin and minimize impacts on people, wildlife, resources and transportation. It would appear that in the interest of time and in the long term money that the single retention structure (Comp. Plan Page V-15, 16 & 17) would be the best.

The plan for drainage of Spirit Lake (2) and sediment containment (3) look good but when are they going to be done and who is going to pay. In other words, our No. (1) concern has not been answered.

We, the U.S. Government, Army Corp, Columbia/Snake River System, State of Washington, Cowlitz County, and the citizens directly involved, have been very fortunate. The U. S. Army Corp has done an excellent job in taking care of the immediate situation in May of 1980 and in all of the clean-up help, draining, planning from then until now -- thank you. We have also been fortunate in that we have not had assistance from mother nature in making another federal disaster. An earthquake of strong magnitude, heavy wet snowfall of unusual magnitude followed by a warm chinook with heavy rains, coupled with another eruptive phase could not only disturb navigation, it could change the direction of the Columbia River and take thousands of lives (human and animal) and billions of property and material with it.

The Port of Vancouver, Washington U.S.A. has endorsed the Cowlitz Community Consensus Postion #2 for long term Mt. St. Helens recovery and whole heartedly supports the oral and written testimony of the Pacific Northwest Waterways Association presented by Peggy Bird, Executive Director - November 29, 1984.

The U.S. Government cannot allow a 16.9 million cost sharing and local land securement project to hold up a program that insures human life and continuance of a major world transportation system that must be done now!!

We ask that you move on our behalf to please assist the U. S. Army Corps and Administration to move forward on this program immediately and thank you for your assistance in the past and future cooperation.

Yours very truly,

PORT OF VANCOUVER U.S.A.

Charles R. Miller
Assistant to Executive Director

CRM:klf

Port of Walla Walla

Port of Walla Walla 29 E. Sumach, P.O. Box 1077, Walla Walla, WA 99362
509/525-3100

November 26, 1984

Colonel Bob Friedenwald, District Engineer
Portland District
U.S. Army Corps of Engineers
P.O. Box 2870
Portland, OR 97208

RE: Mt. St. Helens Feasibility Report

Dear Colonel Friedenwald:

Peggy Bird, Executive Director of the Pacific Northwest Waterways Association will present testimony regarding the referenced Report.

The Commissioners of the Port of Walla Walla concur and support the position of the Pacific Northwest Waterways Association. The Port of Walla Walla believes that damages caused by natural disasters should be corrected on a national basis, not on a state or regional basis.

We appreciate the opportunity to present our comments.

Sincerely,

Roy Nishi

Roy Nishi
Manager

Commissioners:
Ken Jantz
Wes Colley
Fred Bennett

Manager:
Roy Nishi

Longview Public Schools
"In Pursuit of Excellence"

December 11, 1984

Colonel Robert Friedenwald
District Engineer
U.S. Army Engineer
Portland District
Attention: NPPPL-AP
P.O. Box 2946
Portland, OR 97208

Subject: Mount St. Helens Debris Containment Plan

Dear Colonel Friedenwald:

The Longview School District Board of Directors wishes to express its support of the position adopted by the Cowlitz County Board of Commissioners on the above subject, copy attached. With regard to the funding issue, our Board believes that any local taxes for this purpose would create difficult hardships on the local populace. Cowlitz County has never recovered from the recent recession, and any additional taxes would represent a serious hardship.

The Longview School District depends upon the generosity of its patrons to pass special levies with which to fund special programs or building projects. The Board of Directors fears that any new local taxes such as those suggested for the debris retention dam would jeopardize passage of levy and bond issues essential to public school operation. We, therefore, urge you to recommend funding for this project to be entirely from federal and state sources.

Needless to say, we unequivocably support the position that a permanent solution to debris containment be implemented promptly, and that the solution be a single retention dam on the Toutle River. Continued massive dredging is not a viable solution.

Yours truly,

Robert G. Guide

Robert G. Guide
President
Board of Directors

rkm/1759a

Enclosure:

ADMINISTRATION OFFICE
26TH & LILAC LONGVIEW, WA 98632 206-577-2700
SCAN 528-2700

CONSOLIDATED DIKING IMPROVEMENT DISTRICT NO. 1

LONGVIEW, WASHINGTON 98632

SUPERVISORS

L. C. MILLER
CHAIRMAN

NOAH H. ANDERSON
SECRETARY

LYNN CLAPP
ENGINEER

District Engineer
County Administration Building
207 N. 4th
Kelso, WA 98626
Tel. 577-3020

Clerk-Attorney
P.O. Box 205
Longview, WA 98632
Tel. 423-4050

December 14, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P. O. Box 2946
Portland, Oregon 97208

RE: Consolidated Diking Improvement District No. 1 of Cowlitz County - Position on Long-Term Mount St. Helens Recovery

Dear Colonel Friedenwald:

CDID No. 1 is the largest diking and drainage district located within Cowlitz County and is located at the confluence of the Cowlitz and Columbia Rivers. This district, due to its unique location, takes the following positions on issues addressed in the Corps Mount St. Helens Feasibility Report. Please include this letter and comments in the public hearing record.

1. **Implement permanent measures to eliminate the risk created by sediment movement as soon as possible.**

The communities involved are experiencing major social and economic effects arising from the uncertainty about risks of flooding the volcanic activity has brought to this area. The Corps' report is very accurate in describing the impacts to these communities and residents. Some individuals are showing symptoms of severe stress. Community concerns are intensified by the knowledge that solutions are neither simple nor likely to be implemented without some delay. Some residents have chosen to leave the area.

Long-range planning has been impeded. Investment from outside sources has been curtailed and business relocation and expansion decisions are being delayed. Unemployment rates in Cowlitz County have been double digit every month since September 1980. The rate peaked at 20.5% in November 1984, but has been 15.2%, 14.5%, 13.3%, 13.7%, 12.6%, 12.2%, 12.5%, 12.1%, and 11% the first nine months of this year. Even with the interim dredging allowed in PL 98-63, your report estimates $7.1 million in residual average annual damages.

A long-term permanent solution approved and implemented reducing flood hazards would restore normal social and economic conditions and improve the climate for business and investment. Anxiety and uncertainty would be

reduced among district residents. The underlying economic base would be strengthened and the quality of life enhanced. We urge you to approve and implement permanent solutions to the sediment in-fill problems as soon as possible.

2. **We support the preferred plan, a 177-foot structure at the Green River site, downstream dredging and some levee reinforcement, for the following reasons:**

a. It provides the greatest benefits for the lowest cost.

b. It has the physical capability to store most of the material projected to erode off the debris avalanche and reach the Cowlitz and Columbia Rivers over the 50-year project life. Even if the projections on the amount of sediment erosion decreases in the future, we want a structure this size to handle extreme events. Building it in one stage is the most cost-efficient solution.

c. It has the capacity to contain or reduce peak flows from a design mudflow (75 mcy) or a 100-year storm event. This can be done without worsening conditions at the structure site or at downstream damage centers (Castle Rock, Lexington, Longview, and Kelso).

d. It offers maximum flexibility to respond to changing conditions in the unstable Toutle River basin by combining a retention structure with some downstream dredging.

e. It impacts the fewest number of property owners and occupied residences. Only 9 occupied residences out of 24 ownerships would be impacted compared to 13 occupied residences out of 73 ownerships at LT-3 and 34 occupied residences out of 94 ownerships at Kid Valley.

f. It has the least impact on fish and wildlife. Fish migratory paths to the South Fork Toutle and Green River system remain open. The by-pass facility proposed in the preferred plan allows fish access above the structure in the North Fork Toutle River. As sediment is trapped behind the structure, downstream riverbeds and channels will stabilize and turbidity will decrease. Reduction of sediment below the structure will provide some spawning and rearing habitat in the main stem Toutle River. As the channel stabilizes, quicker re-establishment of riparian vegetation will occur.

3. **Non-federal cost sharing is recommended in the Feasibility Report. The district understands the basic concept of non-federal cost sharing; however, for the following reasons, we believe that the district should not be required to participate in funding this project.**

a. The sediment structure is a permanent solution to a unique major disaster. Traditionally the federal government has paid all costs associated with disaster recovery. The district will almost certainly need more disaster relief funds if this structure is not built, especially if abnormal conditions occur.

b. The sediment structure has regional if not national benefits. The Columbia River navigation channel is a major transportation facility that impacts the economy of Oregon, Idaho, and Montana, as well as Washington. Twenty percent of all foreign trade conducted on the West Coast passes through the portion of the Columbia River impacted by Mount St. Helens. Broken down further, it is 9% of the import volume and 27% of the export volume on the West Coast. This is a significant contribution to solving the nation's balance of payment problems as well as assisting the agricultural community.

Interstate 5 and the Burlington Northern-Union Pacific-Amtrack rail line are vital land transportation links on the West Coast. In 1983 the I-5 average daily traffic count in both the north- and south-bound lanes at the Toutle River bridge was 31,000 or 11,315,000 trips for the year. The Burlington Northern and Union Pacific Railroads moved approximately 57,000,000 tons of freight across the Toutle River railroad bridge in 1983. This means 27-36 trains per day including 6 Amtrak trains. This represents 100% of the train traffic between Puget Sound and Portland as this is the only north-south rail line between these two areas. The tracks must remain open to facilitate export grain movement from Puget Sound and Portland on down the West Coast. Costs to re-route that traffic over to Spokane and down the Columbia River are astronomical. Protecting all of these facilities is vital for interstate commerce and transportation. Traditionally the federal government has paid all costs for projects having these kinds of regional and national benefits.

c. The source of the problem is located on federal land. Within the North Fork Toutle drainage basin, 44,400 acres are owned by the federal government. That

constitutes nearly all of the eruption impact area that is causing our problem. It is grossly unfair to ask the State of Washington and Cowlitz County to pay any part of a problem that originates on federal land.

Even though the rest of the country is apparently recovering from the recession, the recovery seems to have by-passed this state and especially Cowlitz County. Many jobs have been lost in the forest products industries because of a depressed national home building market, reduced timber supply and land base, export competition, and shifts in markets. Given the high unemployment rate, it is not only unfair, but highly unlikely, that the state and local government can generate $17 million for a project that has national benefits.

Thank you for the opportunity to comment on this report. The district asks you to give the above points serious consideration when you reach the final recommendation that will be forwarded to Washington, D.C.

CONSOLIDATED DIKING IMPROVEMENT
DISTRICT NO. 1

By Noah Anderson
Noah Anderson, Supervisor

SLW:dw

COWLITZ ECONOMIC DEVELOPMENT COUNCIL

December 14, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, OR 97208

Dear Colonel Friedenwald:

The Cowlitz Economic Development Council urges the swiftest possible action to commence construction of a volcanic sediment retention dam on the north fork of the Toutle River. We also strongly support the dredging and dike protection work which is part of the overall volcanic sediment control plan proposed by the Corps.

For more than five consecutive years, this community has suffered from double-digit unemployment. The explosion of Mount St. Helens in 1980 with its concomitant threat to our communities and the Columbia River shipping channel exacerbated our economic problems.

It is absolutely essential that the Corps take all steps possible to eliminate the threat of volcanic sediment choking either the Cowlitz or Columbia river streambeds. The economic consequences, both locally and regionally, would be disastrous.

The most cost effective way of assuring a maximum level of protection for our communities and the Columbia River shipping channel is to build the retention dam.

We have every confidence that we can help restore our communities to economic prosperity but we must have the threat of flooding from sediment-choked streambeds behind us for good.

p.o. box 202 longview, washington 98632 (206) 423-9921

Mt. St Helens' sediment is more than an economic issue to us. The safety and welfare of the nearly 50,000 citizens who live downstream from Mount St. Helens is also at stake. Thus it is a public safety as well as an economic matter. Its urgency should be obvious.

Be assured we stand ready to assist in whatever way we can to speed this vital action along.

Sincerely,

Karen Pickett

Karen Pickett, President
Cowlitz Economic Development Council

kp/kc

cc: Senator Slade Gorton
Senator Dan Evans
Senator Mark Hatfield
Senator Bob Packwood
Representative Don Bonker
Representative Les AuCoin
Representative Norman Dicks

Longview Chamber of Commerce
1563 Olympia Way
Longview, WA 98632
Phone: (206) 423-8400

December 11, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, OR 97208

Dear Colonel Friendenwald:

The Longview Chamber of Commerce has carefully reviewed the Corps of Engineers Mount St. Helens Feasibility Report and has generally approved the following positions to be included in the public hearing record.

1. Implement permanent measures to eliminate the risk created by sediment movement as soon as possible.

   We are experiencing major social and economic effects that persistent uncertainty about risks of flooding and volcanic activity has brought to this area. Your report is very accurate in describing the impacts to our communities and residents. Some individuals are showing symptons of severe stress. Community concerns are intensified by the knowledge that solutions are neither simple nor likely to be implemented without some delay. Some residents have chosen to leave the area.

   Since long-range planning is impossible, investment strategies have changed and business relocation and expansion decisions are being delayed. Unemployment rates in Cowlitz County have been double digits every month since September 1980. Even with the interim dredging allowed in PL 98-63, your report estimates $7.1 million in residual average annual damages.

   With a long-term permanent solution approved and implemented, reduced flood hazards would restore normal social and economic conditions and improve the climate for business and investment. Anxiety and uncertainty would be reduced among our residents. The underlying economic base would be strengthened and the quality of life enhanced. We urge you to approve and implement permanent solutions to the sediment in-fill problems as soon as possible.

2. We support the preferred plan, a 177-foot structure at the Green River site, downstream dredging and some levee reinforcement, for the following reasons:

   * It provided the greatest benefits for the lowest cost.
   * It has the physical capability to store most of the material projected to erode off the debris avalanche and reach the Cowlitz and Columbia rivers over the 50-year project life. Even if the projections on the amount of sediment erosion decreases in the future, we want a structure this size to handle extreme events. Building it in one stage is the most cost-efficient solution.
   * It has the capacity to contain or reduce peak flows from a design mudflow (75 mcy) or a 100-year storm event. This can be done without worsening conditions at the structure site or downstream damage centers.
   * It offers maximum flexibility to respond to changing conditions in the unstable Toutle River basin by combining a retention structure with some downstream dredging.
   * It impacts the fewest number of property owners and occupied residences.
   * It has the least impacts on fish and wildlife. Fish migratory paths to the South Fork Toutle and Green River system remain open. The by-pass facility proposed in the preferred plan allows fish access above the structure in the North Fork Toutle River. As sediment is trapped behind the structure, downstream riverbeds and channels will stabilize and turbidity will decrease. Reduction of sediment below the structure will provide some spawning and rearing habitat in the main stem Toutle River. As the channel stabilizes, quicker re-establishment of riparian vegetation will occur.

3. Non-Federal cost sharing is recommended in the Feasibility Report. We understand the basic concept of non-Federal cost sharing. However, for the following reasons we believe that local county, district and city governments should not be required to participate in funding this project.

   A. The sediment structure is a permanent solution to a unique major disaster. Traditionally the Federal government has paid all costs associated with disaster recovery. Even with the structure, the County will continue to respond to site specific erosion and flood control problems related to the Mount St. Helens disaster as mentioned above. This has and will continue to tax our financial viability. We simply cannot afford to cost share in the sediment structure while solving the many other related disaster recovery problems for which federal assistance is not available.

   B. The sediment structure has regional if not national benefits. The Columbia River navigation channel is a major transportation facility that impacts the economy of Oregon, Idaho and Montana as well as Washington. Twenty percent of all foreign trade conducted on the West Coast passes through the portion of the Columbia River impacted by Mount St. Helens. Broken down further, it is 9% of the import volume and 27% of the export volume on the West Coast. This is a significant contribution to solving the nation's balance of trade problems as well as assisting the agricultural community.

   C. Interstate-5 and the Burlington Northern-Union Pacific -Amtrak rail line are vital land transportation links on the West Coast. In 1983, the I-5 average daily traffic count in both the north and south-bound lanes at the Toutle River Bridge was 31,000 or 11,315,000 trips for the year. The Burlington Northern and Union Pacific Railroads moved approximately 57,000,000 tons of freight across the Toutle River railroad bridge in 1983. This means 27-36 trains per day including 6 Amtrak trains. This represents 100% of the train traffic between Puget Sound and Portland as this is the only north-south rail line between these two areas. The tracks must remain open to facilitate export grain movement from Puget Sound and Portland on down the West Coast. Costs to reroute that traffic across the Cascade Mountains to

   Spokane and down the Columbia River are astronomical. Protecting all of these facilities is vital for interstate commerce and transportation. Traditionally the Federal government has paid all costs for projects having these kinds of regional benefits.

   D. The source of the problem is located on Federal land. Within the North Fork Toutle River drainage basin, 44,400 acres are owned by the Federal government. That constitutes nearly all of the eruption impact area that is causing our problem. It is grossly unfair to ask local governments to pay any part of a problem that originates on Federal land.

   Even though the rest of the country is apparently recovering from the recession, the recovery seems to have by-passed this State and especially Cowlitz County. Mount St. Helens recovery problems and economic problems have resulted in the high unemployment figures noted earlier. Many jobs have been lost in the forest products industries because of the loss in land base from the eruption devastation, reduced timber supply, export competition and shifts in market. Given the high unemployment rate, it is unfair to ask local governments to financially contribute to a sediment solution that originates on federal land and has national benefits.

   E. Administration officials have previously acknowledged the uniqueness of this disaster and the need for equity in financing a solution.

Thank you for your consideration of this recommendation.

Sincerely,

Karl Salzsieder

Karl Salzsieder, President
Longview Chamber of Commerce

KS/cs

cc: Bob Arkell
Bob Korten
Lewis Bacon

Don Manasco, Manager

Phone (206) 636-3860

Beacon Hill Sewer District

1121 West Side Highway
Kelso, Washington 98626

December 6, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208

Re: District Position on the Mt. St. Helens
Feasibility Report and Environmental
Impact Statement

Dear Colonel:

We wish to express our support for the 177 foot Single Retention Structure at the Green River Site as the preferred alternative long-term solution to the sediment in fill problem resulting from the eruption of Mt. St. Helens. We feel this structure along with downstream dredging and protection of spoils already removed will best address the problem as now predicted and documented in your plan.

We do however, suggest that further consideration be given to your cost share proposal that places the cost of land and easement acquisition on the State and local government. This is a regional problem with national impacts. Regardless of the eventual cost responsibilities, the Corps should be authorized to acquire lands and rights-of-way. They are far better prepared and able to make these acquisitions on the most timely schedule than is the State or County. With a long planning and study process almost behind us, this would insure the most expedient and effective track for construction of the dam which is above all the main goal at hand.

Thank you for the opportunity to comment on this report.

Sincerely,

Edwin F. Rutherford

Edwin F. Rutherford, President
Board of Commissioners

EFR:jz

QUOIDBACH *Construction Co.*

QU-OI-DC+349LF

1355 CALIFORNIA WAY   LONGVIEW, WASHINGTON 98632   PHONE 206 423-5910

December 13,1984

District Engineer
U. S. Army Engineer District, Portland
P.O. Box 2946
Portland, Or. 97208

Att'n: NPPL-AP
Re: Draft Feasibility Report and DEIS for Mt. St. Helens, Washington

Gentlemen:

Our firm came to Longview to build the town in 1923. As pioneer property owners, we have lived and worked behind the dikes of this city, comfortable with the job Consolidated Diking & Improvement District #1 was doing with our tax dollar to protect our interests. However, Mt. St. Helens explosive elevation of the gradient of the headwaters of the Toutle River with highly erosive material has presented our area with an immediate problem we are incapable of dealing with alone. Uncle Sam's Volcanic National Monument will continue to invade our territory with each successive storm.

As a graduate engineer, I have studied in depth both your comprehensive plan and this report and offer my congratulations on a job well done. I basically support the conclusions reached and favor the 177 foot Toutle sediment retention structure above the confluence of the Green River.

Regarding page VII-4, Division of Responsibilities, I have several concerns. Although I recognize the principal of cost sharing, I question the Non-Federal share inclusion of the costs of all lands, etc. and the ambiguity of the wording of "all other mitigation costs of the project".

In its geological lifetime, this area will become a terrace with a concrete waterfall. It would make a unique Federal Park or future entrance to the National Monument, or the land could be interumly leased from Weyerhaeuser, the principal owner, to be returned to their tree farming program.

I am afraid that mitigation costs may be construed by the fishery interests to include compensation and programs to restore the depleted Columbia Basin fish runs. This is a Federal and Regional problem.

Regardless of how Congress elects to fund this work, I hope that it will be expedited without further delay.

Yours truly,
QUOIDBACH CONSTRUCTION COMPANY

R. E. Quoidbach

By: R. E. Quoidbach

REQ/ml

LONGVIEW FIBRE COMPANY

MAIN OFFICE AND MILLS, LONGVIEW, WASHINGTON 98632
1-206-425-1550

December 3, 1984

R. L. Friedenwald
Colonel, Corps of Engineers
District Engineer
U.S. Corps of Engineers
P. O. Box 2946
Portland, Oregon 97208

Dear Colonel Friedenwald:

Enclosed are Longview Fibre Company's written comments concerning the Corps' Mount St. Helens Feasibility Report, in follow-up of my statement in behalf of the Company at the November 29, Public Meeting at the Columbia Theater, Longview. We appreciate the opportunity to comment on this important issue.

Sincerely,

Curt R. Copenhagen

Curt R. Copenhagen
Director of Public Affairs

jb

cc: Van Youngquist, Chairman
Board of Cowlitz County Commissioners

R. B. Arkell
Vice President-Industrial Relations

TESTIMONY ON "MOUNT ST. HELENS FEASIBILITY REPORT,"
U.S. ARMY CORPS OF ENGINEERS, PUBLIC MEETING,
NOVEMBER 29, 1984, COLUMBIA THEATER, LONGVIEW
BY CURT COPENHAGEN, DIRECTOR OF PUBLIC AFFAIRS,
LONGVIEW FIBRE COMPANY

Colonel Friedenwald, Ladies and Gentlemen:

I am Curt Copenhagen, Director of Public Affairs for Longview Fibre Company, Longview, Washington. Thank you for the opportunity for our Company to comment on the Feasibility Report and the Corps' preferred plan for permanent Rivers Sedimentation Control which means so much to the entire region and to Longview Fibre.

We support the Corps' preferred plan of a 177' single retention structure on the North Fork Toutle River at the Green River site, dredging downstream, and some levee reinforcement. A permanent solution to the rivers' sedimentation problems is essential, because the sediment is a continuing threat to our large papermaking operations located near the confluence of the Cowlitz and Columbia Rivers.

Substantial quantities of our raw material, wood chips, and also a source of energy, hogged fuel, originates in Idaho and Eastern Oregon which are transported by barge down the Snake and Columbia Rivers to our Longview Mill. Sediment from the Cowlitz moves into the Columbia and then drifts into the inlet used by our raw material and energy barge traffic, posing a continuing threat to the operation of our mill. Since the mill employs approximately 2,000 people, a shutdown would have a significant negative impact on the local economy, and also on 12 other Company converting plants located across the country. These plants, which employ an additional 1,100 people, primarily depend upon the Longview Mill's products as their raw material. We request the permanent solution to controlling rivers' sedimentation be implemented as soon as possible.

We suggest that in the final decision on any local cost-share, the area's very slow recovery from the deep recession with continued unemployment ranging up to half-again the national average be considered. We believe this project should be fully-funded by the Federal government for these reasons:

* Nearly all of the problem sedimentation originates on Federal land in the National Volcanic Monument.
* The rivers' sedimentation threat reaches far beyond the local area with potential regional and national impact. Blockage of the vital Columbia River navigational channel servicing the Snake and Columbia Rivers Basins, or disruption of Interstate Highway 5 and the major North-South rail line, would have an enormous negative economic impact regionally and perhaps nationally.
* Traditionally, similar disaster recovery projects have received full Federal funding.

We greatly appreciate the Corps of Engineers' fine assistance to this area in the Mount St. Helens aftermath. Congratulations on your excellent and quick work constructing the permanent outlet for Spirit Lake -- we look forward to a quick permanent solution to rivers' sedimentation.

Curt R. Copenhagen
Director of Public Affairs
Longview Fibre Company

Greg Drew
5222 Spirit Lake Hwy.
Toutle, Wash. 98649
November 29, 1984

U.S. Army Corps Of Engineers
Portland District
Portland, Oregon

Dear Sirs:

My name is Greg Drew. I am a member of the Toutle Valley Preservation Association, and President of the Mt. St. Helens Chamber of Commerce. I would first like to dispel a rumor that Toutle area residents are the only people who oppose a dam structure. I first read this insinuating rumor in the Daily News. I would welcome a response if any one knows where the rumpr originated, or why the Daily News printed it, because it is not true. We have talked to citizens and organisations all along the Toutle, Cowlits, and Columbia Rivers, and there are hundreds of people who oppose the dam.

It bothers me that there are people within the Corps of Engineers who are making assumptions about the Toutle River, but who had never heard of this river until the 1980 eruption. The Corps argues that the river is not yet armoring itself because there are not three - foot boulders lining its banks. They say it is unstable - that it meanders, cuts new channels, and moves sand deposits from one area to another. What they have failed to realize is that they are describing a phenomenon that has taken place on this river for generations. I am 34 years old. 25 years ago, I began swimming in the Toutle River. Every summer we had to search for a new swimming hole because the winter's high water had cut banks, changed course, moved log jams, and shifted sand bars. I also remember the upper stretches of river. Near Spirit Lake, the river was lined with large rocks and boulders. After only a few miles, this gave way to a meandering channel lined only with sand bars, pebbles and rocks, most of which were less than one foot in diameter. One could never depend upon the course the river would take until it went under the Harry Morgan Park bridge at Toutle, and started down the canyon which was lined with solid rock walls. Heavy winter rains always brought high,thick, dirty water filled with debris.

It's too bad every one hasn't had the opportunity to see the upper stretches of river in the last year. In August, I had the opportunity to stand on the banks of Coldwater Creek. The creek is contained in a rocked channel, and was running crystal clear, as was Castle Creek, and the North Toutle. If one questions the extent of surface erosion, I am reminded again of that August day three months ago. Next to Coldwater Creek we saw the tracks left by a piece of machinery called a survival cat which made its last run on December, 1982, nearly two years ago. Many people do not realize that once the Spirit Lake outlet is re-routed through Coldwater, the river will by-pass the majority of the debris avalanche.

If there is ever another major mudflow, I would imagine the people living down-stream would rather deal with the mudflow alone, rather than the potential hazard of an additional 50,000 acre feet of water being carried with it.

The citizens of this area are now faced with another dilema. First, the Corps is planning a multi - million dollar structure which many feel is not the best solution, and now, we may be forced to pay for a large portion of its funding. This is wrong. The eruption was a national disaster; it is located on federal land; it affected numerous counties, and involved at least two states. Any programs involving this phenomenon should be 100% federally funded.

In closing, I would like to say that yes, I feel there must be some steps taken to assist the river in its recovery, and to protect those people living down-stream from it. But I do not feel a high retention dam built to block spawning beds and to flood 5,000 acres is the best solution. I would also encourage each and every one of you as concerned taxpayers to do your darndest in obtaining a permit to go up to the mountain. Don't just fly over the area - you can't get even a half-way decent perspective of the recovery which is taking place unless you land, and get out on the surface. Then, judge for yourself.

The above has been a copy of the presentation I gave at the public input meeting held in Longview, Washington on November 29, 1984. In addition, I wish to add some suggestions for helping to solve some of the problems related to sedimentation and recovery; The Mt. St. Helens dilema is supposed to be an emergency situation, and that should supercede asthetic requests from certain organizations. I would recommend the following things be done:

1. Clear the logs from Spirit Lake.
2. Find a suitable vegetation and plant the lower mudflow.
3. Use uper river areas as the 1st dredge disposal sites.
4. Protect banks in some areas.
5. Do channel work on several miles of river just above and below N-1 dam.

Very truly yours,

Greg Drew

Greg Drew

WE WOULD APPRECIATE YOUR COMMENTS

PLEASE WRITE OR CALL

Do you wish to remain on our mailing list? Yes (✓) No ( )

Do we have your correct mailing address? Yes (✓) No ( )

P.O. Box 26 4756 Spirit Lake Hwy

Why a dam? They Built Toutle, Wash. 98649
one I didn't keep it cleaned
out so it broke. Then you tell everyone
that it was supposed to do that. In
my book it sounds like you
People just want to ruin all
Homestead Owner's land.

I hope some day if you own
any Homestead Land, It gets ruined
just like you want to do to ours.
Not only do you want the Dam, You
Also want to widen the Spirit Lake
Hy up to the Volcano, why just
to ruin more Property. It moved
back off the Spirit Lake Hy. now
You're bring it back to my house
so they can speed more up to
the Dam. If you want a dam
Put it back where it was, above
Camp Baker, or no Dam at all.
No Dam! No Dam! No Dam!

Gail Todd
4756 Spirit Lake Hy
Toutle, Wash 98649

Please fold this sheet and tape or staple the edge. -- NO POSTAGE REQUIRED --

WE WOULD APPRECIATE YOUR COMMENTS

PLEASE WRITE OR CALL

Do you wish to remain on our mailing list? Yes ( ) No ( )

Do we have your correct mailing address? Yes (X) No ( )

A high dam on the Toutle River will solve only part of the problem of sediment washing down into the Cowlitz and Columbia rivers. It would hold back a certain amount of sediment to be sure, and help solve the problem in the upper Toutle River.

Sediment behind any dam should be cleaned out in the deeper parts once a year, making room for more to settle there in the future.

A number of smaller dams along the rivers would catch more sediment as the banks along these rivers are piled high now and continually erode filling up the river bed the whole length.

It would help also if stumps, logs and all trash could be cleaned out along the flow of the river. Sediment builds up and makes a place for more trash to build up with the current and put a strain on the river banks until they in turn erode.

Cost sharing for the proposed flood control in this area of the Toutle and Cowlitz rivers sounds reasonable until more thought is given to the property owners who are out of work and are now about to lose their homes because they can not pay the present tax. Unemployment is high in this area.

When I pay my income tax I feel I must be paying a share already. Just too much may be going for things less important. We in this area think flood control is very important (NOW)!

Mrs. Mabel Stewart Longview, Wa.

Please fold this sheet and tape or staple the edge. -- NO POSTAGE REQUIRED --

We the undersigned oppose the construction of a dam on the Toutle River, it is not necessary, all sediment can be removed by dredging.

NAME	ADDRESS
Joseph M Gallant	153 Estes Rd Castle Rock Washington 98611
Terry L. Herndon	186 Fish Pond Rd Kelso Wash 98626
Gary L. Roggenback	120 Gilmore Rd. Toutle, WA 98649
Brian S. Greenwood	1625 Dorothy Ave. Longview, Wa. 98632
Patrick H. Schmitt	618 Studebaker RD. Castle Rock Wash. 98611

We the undersigned oppose the construction of a dam on the Toutle River, it is not necessary, all sediment can be removed by dredging.

NAME	ADDRESS
* [illegible]	709 Riverview Dr. Castle Rock, Wa.
* [illegible]	1314 21st #12 Longview WA
Benny L. Hill	800 N. 6th Kelso
CR (Rolly) Ruff	2406 Burcham "
* Hank [illegible]	4126 Rosewood Street, Lv. WA.
* Kitty Hammer	3303 Tori Lane, Longview
[illegible] L. [illegible]	917 Cedar # 14 Kelso
James A. [illegible]	132 Alpha Dr Longview
* John M. [illegible]	3103 Hawthorn Longview
* Donald L. Binion	P.O. Box 735 Kelso

* denotes floodplain residents

December 16, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, OR 97208

Dear Mr. Friedenwald:

The purpose of this letter is in support of the Cowlitz County Community Consensus Position #2 for long-term Mount St. Helen's recovery.

Briefly, that letter supports immediate action on the Corp's preferred plan, construction of the sediment control structure at the Green River site, downstream dredging, and levee reinforcement.

I support the requirement of no local funding for the project. Mount St. Helens is a unique disaster which occured on federal land. It is unfair to put more of the financial burden on our local community for a solution having regional and national benefits.

Respectfully Submitted,

Douglas G. Noakes

Douglas G Noakes

503 16th Avenue
Longview, Wa 98632

Dec 11 1984

Col. Robert Friedenwald:

Dear Sir.

In no way am I in favor of having a dam in the Toutle River

I know you have heard lots of pro and cons. you know them all.

The ~~river~~ is cleaning it self and has done so many times in the past and if left alone will do so again.

Please leave it alone!

Roy M Hollister

Box 294
Castle Rock wa
98611

December 10, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208

Dear Colonel Friedenwald:

I, as a concerned citizen am writing in hopes of pushing along your concept of a single dam to control the sediment problems in the Toutle River valley area and along the lower Cowlitz river, howerver I feel that since thiswas and is a problem on Federal land, that there is where the financing should come from.

We have friends and neighbors lining in an area where they are having to pay in excess of $4.00 per thousand in assessment alone on an outstanding debt for the raising of dikes, and for some this means they may have to sell or even lose there homes in some cases, now the added burden of having to pay for the acquition of land, the building of a dam will put the final period to there problem.

As for myself, I have had to discontinue my flood Insurance because of the excessive costs, I can NOT afford another expense.

A Long time resident of this community,

[illegible]

Mary R. Springer

[illegible]

[illegible] 98632

Robert N. Vaught
2408 34th Avenue
Longview, WA 98632

December 11, 1984

District Engineer
U.S. Army Engineer District,
Portland
Attn: NPPPL-AP
P.O. Box 2946
Portland, Oregon 97208

Dear Sir:

I wish to express my support for the preferred plan, single retention structure.

I hope that the processing of this proposed project can be done in an expeditious manner.

Sincerely yours,

Robert N Vaught

561 - 24th Avenue
Longview, Washington
December 12, 1984

Col. Robert Friedenwald, District Engineer
Army Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208

Dear Col. Friedenwald:

We are writing to you in fervent support of the dam to control the sediment coming down from Mt. St. Helens. We can't help but be so concerned when we see the sand bars building up in the Cowlitz River and realize how the river is filling up with sediment.

We have lived in this valley for most of our lives and are now in our seventies, with our fiftieth anniversary next year. We do not believe we would lose our lives should a flood occur, and we could survive the loss of our home and furniture—after all, those are just material possessions. But what we could never replace would be the keepsakes of a lifetime—precious pictures of our children and a son who died in the service of his country, genealogies and pictures of our ancestors, scrapbooks, and the like. It would be a hurt that would never heal.

So we ask you to please use your utmost influence to support this dam. We who live in this valley would sleep much better at night if it were built.

Thank you!

Sincerely yours,

John and Hazel Erickson

John and Hazel Erickson

P.S. High priced flood insurance also keeps draining our retirement resources.

Teresa Bombardier
2408 34th Avenue
Longview, WA 98632

December 11, 1984

District Engineer
U.S. Army Engineer District,
Portland
Attn: NPPPL-AP
P.O. Box 2946
Portland, Oregon 97208

Dear Sir:

I support the preferred plan, a 177-foot structure at the Green River site, downstream dredging and some levee reinforcement, because it provides the greatest benefits for the lowest cost.

Also, I would request that this project be funded within the next two years.

Sincerely yours,

Teresa Bombardier

December 13, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208

RE: Mount St. Helens

Dear Colonel Friedenwald:

This is in response to the Mount St. Helens Feasibility Report recently completed by the Corps. Please include this letter in the public hearing record. I have the following comments:

1. First, the Corps should be complimented on the excellent and thorough work done on the report. Our community appreciates the hard work done by your staff.

2. The Corps should take action as soon as possible to construct the 177-foot sediment control structure as well as other measures in the preferred plan. The longer action is delayed, the greater is the likelihood we will suffer major damages from a big storm event, a combination of storm events, or a mudflow. Statistically, it is only a matter of time.

   This area has lived through over four years of stress and anxiety regarding Mount St. Helens. It is also reflected in this area's high unemployment rates and development stagnation. Who would invest in an area with such uncertainty?

3. The federal government should fund the total project cost as it has in the past for cataclysmic natural disasters. Our local governments have already expended over $3 million. This project differs a great deal from "pork barrel" water projects where local cost share is most appropriate. Moreover, this disaster originated on federal land, and the protection to be afforded by this project benefits the region and nation by securing major interstate shipping and transportation facilities.

Thank you for this opportunity to comment.

Sincerely yours,

W.K. Lacey

W.K. Lacey
P.O. Box 106
Kalama, Washington 98625

December 14, 1984

District Engineer
Corps of Engineers
P.O. Box 2946
Portland, OR 97208

Sirs:

I have followed closely the many issues regarding Mount St. Helens and especially the flood threat problems faced by Cowlitz River communities. Before December, 1982, my family lived in the North Kelso area. I witnessed the mudflows of May 18, 1980, and all the subsequent river dredging and levee building.

Even though the new levees were considered to provide good flood protection, there were many times when I felt high levels of anguish over whether or not storm events would cause flooding. My most prevalent feeling was of not knowing what the river siltation problem could be causing to happen next. Now we live on a hill well above flood hazards; however, I can still clearly understand the feelings of those residents along the river as this problem continues.

Therefore, I urge the Corps to as quickly as possible select a final solution to the flood hazard problems and get started on implementation.

With respect to my preference on alternative solutions I support the concept of keeping the debris in the Toutle Valley by building a dam, if necessary. The Toutle Valley has already been destroyed and allowing the debris to wash downstream to the Columbia River would only result in more losses as valuable wetlands are filled with dredge spoils. Columbia River losses may even include the estuary tide lands which could become silted with Mount St. Helens debris.

Sincerely,

Jim Fletcher

Jim Fletcher
108 Barbie Lane
Longview, WA 98632

WE WOULD APPRECIATE YOUR COMMENTS

PLEASE

WRITE OR CALL

Do you wish to remain on our mailing list? Yes ( ) No ( ) ✔

Do we have your correct mailing address? Yes ( ) No ( )

TO WHOM IT MAY CONCERN.

If you can believe you should hold up on building a dam on the Toutle for a few years. Also would you also inform the local people how stable that [illegible] dam is.

I believe one thing you could do to save a lot of money would be to ~~[illegible]~~ eliminate [illegible] [illegible] at Pleasant Hill and save [illegible] in dredging it out below at the mouth of the river and also have a place to put quite a few million yards of sand.

One other thing that would help would be to riprap some of the Toutle to keep it in some sort of a channel instead of wandering all over the valley.

Also protect the sand that has been dredged from the river so you won't ~~have~~ have to dredge it again.

Thank You

Pete [illegible]

1913 22nd Ave

Longview Washington

98632

Please fold this sheet and tape or staple the edge. -- NO POSTAGE REQUIRED --

Dec 15 1984

501 Cline Rd

Castle Rock wa

To whom It May Concern.

I'm writing in regard to the proposed Dam on The Toutle. We feel down stream from the Lake the Toutle is establishing a permanent Channel - vegetation on the banks - fish returning - building & recovering - We do not believe this dam should be built - spending money to buy out huge land owners as Weyerhaeuser - We are grateful for the pumping station & the tunnel that were very necessary - But no dam -

Sincerely

Mr and Mrs Dale Kodad

We the undersigned oppose the construction of a dam on the Toutle River, it is not necessary, all sediment can be removed by dredging.

Name	Address
[illegible] Harper	114 Sierra Dr Kelso
Sally Harper	114 SIERRA Dr. Kelso
[illegible] Black	1108 4th Castle Rock
[illegible]	4915 Pleasant hill Rd. Kelso
Elaine [illegible]	4915 Pleasant Hill Rd Kelso

Longview Wash.
December,14,1984.

Colonel Robert Friedenwald:

Dear Sir:

Along with a lot of other people here in Longview and Kelso, I urge immediate action by the Corp,for the construction of the sediment control dam at the Green river site.

Because the disaster occurred on Federal land,we feel that no more funding be required. After all, the solution does have regional and national benefits.

Thank you for anything you can do to get the project going.

I am pleased at the progress with the tunnel project.

O.G.WOOLDRIDGE. * local funding.

O. G. Wooldridge

P.O. Box 694
Longview, Wn. 98632
Dec. 14, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, Ore. 97208

Dear Sir:

In regard to the construction of the sediment control structure at the Green River site, I hope this project will receive your immediate action. Because of the unique disaster caused by the eruption of Mt. St. Helen's, I feel no more local funding should be required.

Also, due to the heavy snowpack in the mountains, which is comparable to the snowpack of 1948 at this early date, another Vanport flood disaster which occurred in the spring of 1948, could be a very real possibility in the Spring of 1985 in this area.

Thank you for your concern and serious consideration of the flood problems of this area affected by the Mt. St. Helen's eruption.

Respectfully yours,
M. Studeman

561-21st Ave
Longview, Wa. 98632
December 15, 1984

Colonel Robert Friedenwald,

We are writing to you out of concern of Mt St. Helens and the possible effects it could have in this community.

We would like you to very strongly support immediate Corps action to construct the sediment control structure at the Green River site. Also we feel there should be no more local funding required.

Mt. St. Helens was a unique disaster that occurred on Federal land. It is unfair to put more financial burden on our local community for a solution having regional and national benefits.

Again we strongly urge your support on this matter. We hope we can count on your support and thank you for your consideration to our very concerned plea.

Sincerely,

Harry & [illegible] Clifton

12 December 1984

Dear Colonel Fredenwall,

As a concerned citizen of Cowlitz County, I understand the Federal Government is trying to put it to us one more time.

I am <u>not</u> in favor of local funding for the construction of the sediment structure; but recommend the Federal Government take care of their property which caused the problem. The federal government waste good money on buying expensive parts for the military; waste money shuttling Congressmen & Senators out of Andrews Air Force Base, etc. Do not use local funds.

I also support immediate action on the Corps' proposed plan of the sediment control structure at Green River, downstream dredging and levee reinforcement.

With all of these actions taken, maybe my flood insurance will

2

get down from 200 plus dollars to the original $8/45.

Thanks for listening!

Stephen W. Hays

Jesus gives me courage!

Dear Sir,

It was called to my attention how important it would be to write you a letter concerning the Green River site.

My husband and I have lived in the area for almost eleven years now.

What used to be a booming place seems to be slowly dying due to many things. Mount St. Helens, economy etc.

Jesus gives me courage!

We believe due to economic circumstances this is a problem. Many people have their homes for sale and are trying to get out of the area.

We do not believe the financial burden should be placed on a local community level.

We support immediate Corps action to construct sediment control structure at the Green River site;

Mount St. Helens was a unique disaster that occurred on Federal land and should be supported financially by the federal government funds.

Thank you,
Richard and Joan O'Neill

December 16, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, OR 97208

Dear Mr. Friedenwald:

The purpose of this letter is in support of the Cowlitz County Community Consensus Position #2 for long-term Mount St. Helen's recovery.

Briefly, that letter supports immediate action on the Corp's preferred plan, construction of the sediment control structure at the Green River site, downstream drødging, and levee reinforcement.

I support the requirement of no local funding for the project. Mount St. Helens is a unique disaster which occured on federal land. It is unfair to put more of the financial burden on our local community for a solution having regional and national benefits.

Respectfully Submitted,

Linine F. Randolph

Linine F. Randolph

2550 Lane Ave
Longview, Wa 98632

December 16, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, OR 97208

Dear Mr. Friedenwald:

The purpose of this letter is in support of the Cowlitz County Community Consensus Position #2 for long-term Mount St. Helen's recovery.

Briefly, that letter supports immediate action on the Corp's preferred plan, construction of the sediment control structure at the Green River site, downstream drødging, and levee reinforcement.

I support the requirement of no local funding for the project. Mount St. Helens is a unique disaster which occured on federal land. It is unfair to put more of the financial burden on our local community for a solution having regional and national benefits.

Respectfully Submitted,

Frank J Sarysz

Frank J Sarysz

4123 Pleasant Hill Road
Kelso, Wa 98626

December 16, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, OR 97208

Dear Mr. Friedenwald:

The purpose of this letter is in support of the Cowlitz County Community Consensus Position #2 for long-term Mount St. Helen's recovery.

Briefly, that letter supports immediate action on the Corp's preferred plan, construction of the sediment control structure at the Green River site, downstream dredging, and levee reinforcement.

I support the requirement of no local funding for the project. Mount St. Helens is a unique disaster which occured on federal land. It is unfair to put more of the financial burden on our local community for a solution having regional and national benefits.

Respectfully Submitted,

Bernice L. Mackey

Bernice L. Mackey
329 Williams Road
Kelso, Wa 98626

Ray Ryan
243 Cook Ferry Road
Castle Rock, WA 98611

December 17, 1984

Colonel Robert Friedenwald
District Engineer
U.S. Army Corps of Engineers
PO Box 2946
Portland, OR 97208

Dear Colonel Friedenwald:

I wish to register my support for immediate construction of the proposed sediment control dam at the Green River site on the Toutle. It is imperative that this action be taken without delay and be supplemented with dredging of the Cowlitz River from Castle Rock to it's confluence with the Columbia River. There simply are not enough dredge spoil sites available upon which to place spoils at the current rate of flow into the Cowlitz. The consequences of inaction will be far more costly than the dam.

I am concerned however, that this project may be delayed by controversy over the issue of local funding. This county has been and is continuing to "Pay The Price" for the eruption of Mt. St. Helens. This has not been an experience that we wished upon ourselves anymore than one would a tornado, hurricane, or earthquake. We have already "Paid Our Share" in local costs and human suffering, yet there appears to be increasing pressure to add to our burden by requiring local cost sharing for the dam. We HAVE born the costs within our means and I ask this be considered before anymore burdens be placed upon our already depressed economy. This country has always SELF INSURED against disasters and we have not objected over the years to tax dollars being expended for Mississippi floods, or mid-west hurricanes. I, therefore, expect past policies to be continued.

One must remember that this is not a dam PROJECT, but disaster aid we are discussing.

Sincerely,

Ray Ryan

Ray Ryan

December 16, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, OR 97208

Dear Mr. Friedenwald:

The purpose of this letter is in support of the Cowlitz County Community Consensus Position #2 for long-term Mount St. Helen's recovery.

Briefly, that letter supports immediate action on the Corp's preferred plan, construction of the sediment control structure at the Green River site, downstream dredging, and levee reinforcement.

I support the requirement of no local funding for the project. Mount St. Helens is a unique disaster which occured on federal land. It is unfair to put more of the financial burden on our local community for a solution having regional and national benefits.

Respectfully Submitted,

Michele V Bogdon

Michele V. Bogdon

#6 Independence Court
Longview, WA 98632

December 16, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, OR 97208

Dear Mr. Friedenwald:

The purpose of this letter is in support of the Cowlitz County Community Consensus Position #2 for long-term Mount St. Helen's recovery.

Briefly, that letter supports immediate action on the Corp's preferred plan, construction of the sediment control structure at the Green River site, downstream dredging, and levee reinforcement.

I support the requirement of no local funding for the project. Mount St. Helens is a unique disaster which occured on federal land. It is unfair to put more of the financial burden on our local community for a solution having regional and national benefits.

Respectfully Submitted,

Robin Schwalm

Robin Schwalm

801 North 4th Ave
Kelso, Wa 98626

Col Friedenwald

There are many reasons I oppose a dam on the Toutle River.

① Why not clean the sediment out of the dam you have already built & it could be used

② There is no danger of flooding as the Cowlitz has never gone over the May 18 1980 level plus now we have 20' more elevation on the dikes.

③ The sediment is a problem however the North fork of the Toutle will slowly clense itself as the South Fork has -- remember when it was imperitive that a dam be built there. Dredging contracts could be issued to contain the amount of sediment

④ High dams kill fish, having caught many salmon on the Toutle; maybe people will again be able to do the same.

⑤ The pipe from Spirit Lake will put the water where there will be less sediment washed down stream

Jack [signature]
114 Sierra Dr.
Lexington (Kelso)
I live in the lowest place in the area

December 11, 1987

Colonel Robert Friedenwald
District Engineer
Corps of Engineers

RE sediment control structure at
the Green River site

Dear Colonel Friedenwald

The purpose of this letter is to request immediate action by the corps for construction of a sediment control structure at the Green River site

It is my opinion that Mt St. Helens continues to pose a threat to my family. I would hope that the federal government realizes that the St. Helens disaster occurred on federal land and that it would be unfair to put more financial burden on this community.

Thank you
William J. Weiss

December 17, 1987

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland Oregon

Bert Lake
3364 Ol[illegible] Wy
Longview Wash.

Gentlemen:

I am writing on behalf of the Mount St. Helens sediment control structure.

I strongly support immediate construction of the sediment control structure at the Green River site, down stream dredging and levee improvement along with the payment of no local funding. I feel that the solution should be handled nationally and not place additional financial burden on local residents.

Very truly yours

Bert [illegible]

Colonel Robert Friedenwald December 12, 1984
U.S. Army Corps of Engineers
Portland District
ATTN: NPPPL-AP
P.O. Box 2946
Portland, Oregon 97208

Dear Colonel,

I'd like to express my support for the proposed 177 ft. sediment retention dam on the Toutle River at the Green River site. It is a sound permanent solution to the in-filling of the Toutle-Cowlitz-Columbia Waterway that we currently face. Existing dredge disposal sites should be protected along with the dam project. It is the single most blatant and embarrassing issue that confronts those of us who support this solution. Most people in Toutle & those others opposed to a dam point to the already dredged spoils eroding in huge chunks back into the river as failures in Corps strategy & decision making process. I understand that early on projects were improperly funded for long-term maintenance, but with the benefit of several years on-site experience, its time these problems were addressed and put aside.

The general receptiveness ~~to and~~ credibility of the Corps and their proposals would be greatly enhanced if basic obvious violations of common sense were

corrected, even at this late date.

I also think that too much baseless fear has been allowed to breed and circulate regarding the potential threat of the dam. I've attended most of the meetings held by the Corps at Toutle, Castle Rock, Kelso High, Beacon Hill and the Courthouse. Frequently the concern is expressed especially in Toutle and Castle Rock, that a dam on the Toutle would only add to the potential threat of a catastrophe. Analogies are constantly drawn between this sediment retention structure and the cracking or leaking water retention dams and reservoirs of California or elsewhere. It's my understanding that a minimum amount of water will be stored or reservoired for settlement behind the dam and the more sediment deposited the stronger the structure becomes. Yet when the fear is expressed it usually comes when only public testimony is being given thus each concern goes unaddressed by the Corps. However, in-between times the Corps could resolve these fears and mis-statements by speaking to the issue. Either it is or isn't a catastrophic risk.

Thanks for the opportunity to submit my opinion.

Sincerely,

Don Manasco
101 Yelton Drive
Longview, Wash. 98632

720 Ostrander Rd.
Kelso Wash. 98626
Dec. 12, 1984

Col. Robert Friedenwald,
Dist. Eng. Army Corps of Eng.
P.O. Box 2946
Portland, Ore. 97208

Sirs,

If the dam is the best and cheapest way to solve the Mt. St. Helens problem, I would want that.

Also I oppose a Corps recommendation that the local and state pay millions toward the dam. It's Federal land so it should be paid for by the National Government I think.

Thanking you

(Mrs.) Lillian Bundy

[illegible]
Longview Wash. [illegible]
Dec. 12, 1984

Col. [illegible]
District Engineer
[illegible]
P.O. Box 2946
Portland, Oregon [illegible]

Sirs,

[illegible]

Respectfully
[illegible]
([illegible])

December 11, 1984

Col. Robert Friedenwald
District Engineer
Army Corps of Engineers
P.O Box 2946
Portland Oregon 97208

Dear Col. Friedenwald
An article in the Longview Daily News dated December 11, 1984 requested residents to write to you and urge construction of a 177 foot retaining dam on the Toutle River.

I am opposed to the construction of a dam because of the high cost and the fact that the Cowlitz river will still be filled with sediment.

I would favor dredging the Cowlitz river from the mouth to Castle Rock. I realize that finding close spill sites might be impossible but there are many sites within 10 miles of the Cowlitz River.

If a fleet of 10-12 yard dump trucks were used to haul the sediment many low lying areas could be filled and provide many commercial or residential building sites.

If the cost of each truck was $500.00 per day, 100 trucks would cost 50,000.00 per day or 250.000.00 per week. If you use a 50 week period the ~~total~~ trucking cost would only be 12,500.000.00

If you allot an additional 12,500,000.00 for dredging and sites the total cost would be less than 10% of the 292 Million cost for the dam.

I do not own any spill sites and I have no interest in trucks. My home is well above the flood plain but I do own rental properties in Longview and Kelso that might be flooded if the Cowlitz is not dredged.

I would think that a 25 Million package would be a lot easier to sell to Congress than the 292 Million package.

A reply stating that you have read this letter will be appreciated.

Yours truly
W.A. Presnell
3007 Madrona Place.
Longview Wa.
98632

WE WOULD APPRECIATE YOUR COMMENTS

PLEASE

Do you wish to remain on our mailing list? Yes (X) No ( )

Do we have your correct mailing address? Yes ( ) No (X)

My correct mailing address is: Mike & Joyce Coffey
2250 South 17th
Coos Bay, Oregon
97420

Without knowing what is possibly being considered as solutions, it is hard for us to make much of a comment.

We have faith in the Corps of Engineers to do a good job and appreciate a chance to voice our views. We look forward to seeing the ~~the~~ results of the Detailed Study due to be finished in Sept. 1985.

Right now all we can comment on is that we consider the environmental aspects very, very important!! If these aspects are considered thoroughly at the very beginning, then there should be no problems at the finish!!

Michael & Joyce Coffey

Please fold this sheet and tape or staple the edge. -- NO POSTAGE REQUIRED --

---

To Mr Jon D. Katin
Lieutenant Colonel, CE
Acting District Engineer

From: Zoltan Kosa
111 Frank St
Longview. Wa. 98632
11 - 10 - 1984

Re: Mt. St. Helens, Washington Feasibility Report. a Draft Environmental Impact Statement.

Dear Lieutenant Colonel Katin.

Thank you for this opportunity to comment on the above said Environmental Impact Statement.
Being a residence of Cowlitz Co. for the past 20 years, We will be affected (Including my family also) with the outcome of this proposed projects.

We are preferring the Single Retention Structure alternative to be built at the Green River Site, approx. RM 13.5 on the North Fork Toutle River. We would like to see, that the structure will be designed and the foundation is constructed so that the structure itself could be built upto 202' Hight if needed, than use stage construction technique to accomplish objectives. Refer to Page VI-6, Table VI-2 item (3).

We prefer this alternative because of the unknown amount of loose material, which is out there, but nobody really knows at this time, that how much of that material is going to move downstream.

Sincerely

Zoltan Kosa

WE WOULD APPRECIATE YOUR COMMENTS

PLEASE WRITE OR CALL

Do you wish to remain on our mailing list? Yes (✓) No ( )

Do we have your correct mailing address? Yes (✓) No ( )

Dec 14, 1984

Alan W. Godfrey
150 Godfrey Rd.
Kelso, Wa 98626

Dear Sir,

I attended the meeting in Longview on the Silt Retaining Structure on the Toutle River.

I've lived here virtual all my life of 45 years. The Toutle was one of my favorite recreational areas. I don't like to see this happen, meaning the S.R.S. But I feel it will be for the good of the Area down stream to control the silt flow into the waterways. ~~to the~~

Where I live is on the old Kelso mudflow at 100 ft elevation at one time the level was approximately 175' ele. It seems to be quite stable now.

But looking at the rivers as long as silt runs the channels change like downstream at Puget Island. I sure This is caused by silt flow from Mt. St. Helens.

The SRS. is not only important to the County of Cowlitz but to the State of Washington & Oregon along the rest of the Country. Also to the world.

Please fold this sheet and tape or staple the edge. -- NO POSTAGE REQUIRED --

WE WOULD APPRECIATE YOUR COMMENTS

PLEASE WRITE OR CALL

Do you wish to remain on our mailing list? Yes ( ) No ( )

Do we have your correct mailing address? Yes ( ) No ( )

I know with The depress condition of this area. We the Tax payers can not even share in the cost of the SRS on a county or a state level.

I think this should be funded on a strict federal level. So that every one can enjoy the cost of a natural disaster that we've lived with for the past 4½ years.

The S.R.S. should be built of good solid material also kept ~~to~~ within the natural beauty of the area as much as possible. If it isn't built solid always remember the "Teton disaster"

What about future plan for a hydro-electric project using flume to transfer the water to generators?

I've hope to live here many more years. Some of my Sons are also living here.

And again I do stress the importants of Total Federal Funding for this project. because of the importants to the country as a whole.

Also. Do it As Soon As Possible

Thank you

Alan Godfrey

150 Godfrey
Kelso, Wa 98626

Please fold this sheet and tape or staple the edge. -- NO POSTAGE REQUIRED --

12/15/84

Col. Robert Friedenwald
District Engineer
Army Corps of Engineers
P.O. Box 2946
Portland, Ore. 97208

Dear Sir:

My wife and I urgently support quick construction of the proposed 177 foot tall debris retaining dam on the Toutle river to lessen possible flooding downriver in Longview where we live.

We also oppose the Corps recommendation that local and state governments contribute up to $17 million toward the costs of such a dam.

Sincerely
Mr & Mrs Lee Walstead
2829 Fir
Longview, Wa. 98632

WE WOULD APPRECIATE YOUR COMMENTS

PLEASE WRITE OR CALL

Do you wish to remain on our mailing list? Yes (✓) No ( )

Do we have your correct mailing address? Yes (✓) No ( )

Speaking as a layman and resident citizen, my continuing concerns are:

#1. The delay in implementation of a majority consensus solution, namely the single retention dam with appropriate dredging.

#2. The economic effects that continue to accumulate and aggravate with the uncertainty of implementation of this viable solution.

#3. Volcanic eruptions on federal land are not a common occurrence in the U.S.A. therefore we are not being provincial in our expectations of relief.

#4. Your in depth procedural efforts have been lucid and valid but the legend of "Damocles" will continue to disturb the man on the street:

"How much longer will the thread hold?"

Sincerely,
Karl Jonasson

KARL O. JONASSON
815 S. 3RD
KELSO, WASH.
98626

Please fold this sheet and tape or staple the edge. -- NO POSTAGE REQUIRED --

12/14/84

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208

Dear Colonel Friedenwald,

I am asking you to support the construction of a sediment control structure at the Green River site. I have lived in Longview for 38 years and have never seen the Cowlitz so chocked with sediment that one could walk three fourths of the way across on sediment. This was easy to do this summer.

I would thus seek to enlist your support for immediate corps action to construct the sediment control structure on the Green River site and to do this without the help of local funding. It is unfair for us to pay for a disaster that occured on federal land.

I personally have paid better than a thousand dollars just for flood insurance in the last 4 years.

Thank you for your cooperation.

Sincerely,

Lee Culkin
297 16th
Longview, WA.
98632

Dec. 17, 84

Mr. Friedenwald,

I am writing to you as a concerned citizen of the Longview area over the issue of sediment Control at the Green River site.

I do support the belief that an immediate Corps action to construct a sediment control structure at the Green River site is a necessity - Now - and that no more local funding should be necessary or required. It is highly unfair to put more financial burden on our local community for a solution having regional and national benefits.

Thank you kindly for your cooperation in this matter.

Sincerely,

Carolyn Shelton

Dec 13, 1984

Dear Sir;

I am a Tax paying Home-owner Residing in Longview Wash

I urge you to Start the Debris Dam on the Toutle River

I feel if this is not done, the Silt will clog Cowlitz + Columbia River at the port of Longview Stopping Ship traffic to Longview, Kalama, + Portland Ore. Causing untold Revenue.

This Community has and is now Suffering in many ways Construction is way down, houses are not Selling Causing Economic hardships to all. the Federal Flood Ins. has tripled and More, so that many of us, including me Cannot afford the premiums

I also believe the prop-osal to has Cowlitz County Residents to Levy 17 million dollars is too much + will Raise Taxes to the point we cannot pay them + Lose everything we have.

I Respectfully ask you Consider this request because it surely is Valid.

Respectfully,

Arnold R Olson
333-18th
Longview Wash
98632

Mrs. V. K. Harvey
686 25th Ave.
Longview, Wash. 98632

District Engineer
U.S. Army Engineers
Portland District
Attn. NPPPL-AP
P.O. Box 2946,
Portland, OR 97208

Gentlemen:

Construction of a retention dam on the Toutle River must be accomplished to protect the cities downriver.

To saddle the cost of this dam on the residents of these cities would be almost as disastrous for them as a mud-flood. Many of us on fixed pension incomes can no longer even afford flood insurance. Nor can the many who are out of work.

We do pay federal taxes and the cause of all this is on federal land. Therefore, that should be the source of payment.

Very truly yours
Penelope V. Harvey

---

500 Church
Kelso, Wa. 98626
Dec 11, 84

Col. Robert Friedenwald
Dist. Engineer.
Army Corps of Engineers:
P.O. Box 2946,
Portland, Oregon 97208

Dear Sir;

We live in Kelso, Wa. near the Cowlitz River, and have had many worries and problems since Mt. St Helens Blew up & filled our river with silt.

We are very much in favor of the quick construction of the 147 ft dam on the Toutle River. I'm sure it would be much better judgement to build the Dam, then pay to dredge both the Cowlitz & Columbia rivers for years to come. We need the dam for our protection.

Sincerely
Mr & Mrs A.W. Mott
500 Church, Kelso, Wa 98626

Dec. 11, 1984

Col. Robert Friedenwall; District Engineer.
Army Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208

Dear Sir:

I hope you understand this community is vitaly concerned with the construction of the 177 foot tall debris-retaining dam on the Toutle River and request you to proceed in any way necessary to obtain the congressional funding

It should be made clear since Mt. St. Helens is on federal lands It is unfair to put additional financial burden on the local community for regional and national benefits.

Sincerely
Mrs. Elaine E. Bradford
2024 Tibbetts Dr. #99
Longview, Wa 98632

Dec. 12, 1984

Col. Robert Friedenwald:

I would like to express my views on the proposed retention dam on the north Toutle River.

I am a retired land surveyor and timber cruiser, and worked on most of the Toutle River after the eruption in 1980 and 1981 cruising heat killed trees for the Weyerhaeuser Co. and other land owners, including areas well above the proposed location of the retention dam.

I found miles of the river valley filled with soft sand, pumice, etc. in places ½ mile wide and 12' to 16' deep, a pickup would sink out of sight, and no rock armoured banks, as some are reporting.

I do not attempt to estimate the million yards of sedimate that will eventually ~~couldti~~ wash in to the Cowlitz in the next 25 or more years, as the Corps is well qualified to do this, however my view is that the retention dam is needed.

Most of the opposition comes from residents of Toutle, who would not be affected by flooding of the Cowlitz valley, or lose property acquired under the 'eminent domain' law, as residents in the Cowlitz River valley are.

Alden Jones is showing slides taken in summer when pumps were shut down, this is not a true picture of the danger. The same area he shows as a trickle of water in summer can be a raging flood, uprooting trees 4 feet in diameter in dense storms

Respectfully Gordon Kerr

Longview, Wa.
65? 15th

Col. Robert Friedenwald
District Engineer
Army Corp of Engineers
Portland, Oregon.

Dear Sir;

Please construct a Dam on the Toutle River at the earliest possible time. Also I'm opposed to the Corps recommendation that State and local Governments pay 60% of the total costs of the Dam.

Thank you,
Yours Sincerely,
Lois Hartwell

Dec. 12 '84

Sir,

Being residents of the low lands we are urging the quick construction of the dam on the Toutle River. Many of the citizens of Cowlitz County have had to let our flood insurance lapse because of the continuing expense. Also in regards to the recommendation that we assume 4% of the total cost, please remember that our local unemployment is well above the national level.

Sincerely
Mr, Mrs L. S. Peru

12-8-84

Dear Colonel Friedenwald,

We are in support of immediate action on the construction of the Sediment Dam on the Toutle River, at the Green River site. We also need levee reinforcement and downstream dredging.

We do not feel local funding for this project is fair, as this community has had an unfair financial burden put on it already because of the Mt. St. Helens disaster.

Sincerely,

G. A. Rolfe Sr.
Grace A. Rolfe

Dear Sirs.

Please build the dam soon - we really need it so very much.

We've been under the cloud for too long.

God bless you

Shirley G Dalsgard

December 14, 1984

Col. Robert Friedenwald
District Engineer
Army Corps of Engineers
P. O. Box 2946
Portland, Oregon 97208

Dear Sir:

A high dam to ratain debris from flowing down the Toutle River needs to be built immediately and the federal government should finance this dam. It is urgent that it be started as soon as possible and be completed with dispatch.

Cowlitz county has not seen the recovery that is in evidence for much of our country. The volcano which caused the debris which will be washed down onto our communities with unusually high rainfall or some unforeseen cataclysm is no fault of the residents of Cowlitz county; it is an act of God and our nation should see that no more disaster strikes our residents than can be helped.

Respectfully,

Roland A. Lyons
Morita A. Lyons
3203 Lindsey Drive
Longview, Washington
98632

Dist. Engineer 12-12-84
Army Corp of Engineers
P.O. Box 2946
Portland, Ore

RE - Dam on Toutle

Dear Colonel Friedenwald,

This is a request to please get the dam built on the Toutle River to protect the Toutle drainage system.

We lost our home & all of our possessions during the Volcano. We're fine now but why should others have to live in fear?

Something has to be done so please do the best that's available at this time.

Thank You

[illegible]
235 [illegible] Rd
[illegible] Wa 98611

Dec. 14, 1984

Corps of Engineers
Attn: Col. Friedenwald

I am writing in support of the construction of the sediment control structure at the Green River site. We are still not "resting easy" here in Kelso, & want to be heard again when the funding decisions are made (& before the big federal cuts hit us!)

We need help! Local funding alone cannot begin to do the job!

Sincerely,
Mrs. E. H. Peterson

2655 Maple Street
Longview Wa 98632
December 14, 1982

Col. Robert Friedenwald, Dist. Eng.
Corps of Engineers
P.O. Box 2946
Portland, Or. 97208

Dear Sir:

Please take immediate action to construct a sediment control structure at the Green River site to prevent flooding of the area below. You are well aware of the lives and valuable property at stake.

Since Mt. St. Helens was a unique disaster and occurred on Federal land, further local funding should not be required. It is certainly unfair to put further financial burden on this community for a solution having regional and National benefits.

Respectfully,
Margaret B. Gudgel

IIIO N. Third Ave.

Kelso, Washington 98626

Dec. I5, 1984

Colonel Robert Friedenwald

District Engineer, Corps of Engineers

P. O. Box 2946

Portland, Oregon 97208

Dear Sir:

I understand that this is the time when project funding decisions are being made. It has been over four years since the disasterous Mt. St. Helens eruption. I am writing to ask your support for immediate action on the construction of the sediment control structure at the Green River site and asking that no more local funding should be required.

Sincerely,

Mrs. A. J. Larsen

December 14, 1984

Col. Robert Friedenwald

District Engr.

Corps of Engrs.

P.O. Box 2946

Portland, Oregon 97208

Dear Col. Friedenwald:

We totally support immediate action by the Corps of Engineers to construct the sediment control structure at the Green River Site and believe that we have had enough of a financial burden locally. We feel that Federal financial support is of the utmost importance at this time.

Very truly yours,

Mr. & Mrs. W. A. Kemper

505 Division
Kelso, Wash.
Dec. 14, 1984

Dear Colonel Friedenwald—

Every one I talk to believes that a sediment retaining structure should be built at the Green River site — and stop dragging this issue from year to year. It is a terrible feeling to be worrying about this every winter.

If at all possible there shouldn't have to be anymore local funding — since it ocurred on Federal land. and it would benefit the region, the shipping lanes, etc

Thankyou Sinerely,

Zelba Saffel

12-14-84
Longview

Dear Colonel
Robert Friedenwald

Just wanted to let you know my support for Corps plan to construct a sediment retentral structure at the Green River site immediately.

I think that no more local funding should be required, because St. Helens eruption disaster occured on federal land. It is unfair to put more financial burden on our local community for a solution having regional and national benefit.

This is also the time of deep federal budget cuts considered in Congress!

If we lack immediate action for Corps plan we won't have chance to fund this project

Sincerely & hopefully
J. Kaplin
2819 Lilac Longview

12-14-84

Colonel Robert Friedenwald
District Engineers Corps of Engineers
P O Box 2946 Portland Ore. 97208

Dear Sir:

We support your immediate action to construct a sediment control structure at Green River site, as we have home in West Kelso & business in Longview.

We feel the mountain is still a danger but it should be payed for by the government. the disater occurred on federal land.

We as senior citizens can't afford any more taxes.

Thank you

Yours truly
Frank & Hope Taylor
204-S-5th-W
Kelso Wash. 98626

1755 Arkansas St.
Longview, Wa.
December 14, 1984

Dear Robert Friedenwald, Colonel

We as Citizens of U.S.A and residents of City of Longview We are much Concerned about Mount St. Helens.

My husband and I would like for the Corps action to Construct the sediment Control structure at the Green River site, and that no more local funding should be required because this desaster occured on Federal land, and we feel the federal Government should start doing something about it soon. We feel it is very unfair to Put more financial burdens on our local Community. Do hope you Can do something. The old saying goes, "A stitch in time saves nine." Do hope you Can do something about this situation.

Sincerely
Robert + Selma Bricknell

Longview Wa.
12-14-84

Dear Col. Friedenwald:

Kelso & Longview are in danger of bad flooding in case the dike broke or other things happen.

There are two issues to be stressed. My support for immediate Corps action to construct the sediment control structure at the Green River site & that no more local funding should be required. Mt St Helen's was a unique disaster that occurred on federal land. It is unfair to put more financial burden on our local Community for a solution having regional & national benefits.

Sincerely
Daisy Turner
1614 - 17th ave
Longview Wa.

Gentlemen:

We stress your immediate support for action to construct the sediment control structure at the Green River site —

And that no more local funding should be required. Mount St. Helens was a unique disaster that occurred on federal land.

It is unfair to put more financial burden on our local community for a solution having regional and national benefits —

Mabel Kent
Longview Wa.
98632

MRS. C. D. PEASE
3233 WILDWOOD DR.
LONGVIEW, WA. 98632

Dec. 14, 1984

Colonel Robt. Friedenwald
District Engineer
Corps of Engineers
Portland, OR.

Dear Colonel,

I am writing to urge the corps to take quick action to construct the sediment control structure at the Green River site. We who live in this area feel as if we have a time bomb up there. If it goes off, our communities could cease to exist. It would be great if we could finance it ourselves but no locality could do that. This was a disaster that occurred on federal land & the solution to the problem should be national.

Please do what you can.

Sincerely.

Mary L. Pease

---

135 Maddux Rd
Castle Rock, Wash 98611
December 13, 1984

Colonel Robt Friedenwald
Dist Engineer of Corps of Engineers
Box 2946
Portland, Ore 97208

Dear Sir,

We feel it is imperative that the sediment dams on the Toutle River be built as soon as possible!

Sincerely
Mr + Mrs C E Whittle

December 14, 1984

Col. Robert L. Friedenwald
U.S. Army Corp of Engineers
Attn: NPPPL-AP
P.O. Box 2946
Portland, Oregon 97208

Dear Colonel Fiedenwald:

We wish to express our view of the solution regarding Mt. St. Helens and the problems created with it. Since May of 1980 we have lived with the potential hazards of flooding on the Toutle and Cowlitz Rivers. We have carried National Flood Insurance since May 1980, however due to the increase in cost (from $30.00 in 1980 to $193.00 in 1984) we are concerned if we will be able to afford it in the future. We know of many who are unable to afford it as the cost rises so fast.

We strongly support immediate action on the construction of the 177 ft. debris retaining dam on the Toutle River. We also feel that the Federal Government should finance the total cost of such a dam. Our local economy is poor and as this was a "disaster" we feel we local citizens should not have to take on further burdens.

We are watching this situation with extreme interest.

Sincerely,

Mrs. Jeffry L Davis

Mr. & Mrs. Jeffrey L. Davis
4406 Constitution Lane
Longview, WA 98632

December 11, 1984

Col. Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208

Dear Col. Friedenwald:

Cowltiz County has a unique problem, as you are well aware. The eruption of Mt. St. Helens on federal government land in May, 1980 has provided all residents downstream of the Toutle, Cowlitz and Columbia Rivers many sleepless or at least restless nights.

The Corps of Engineers has provided much help to these residents and it is greatly appreciated; but, now The Corps has the opportunity to provide permanent flood control measures to the downstream population. We urge you to take immediate action to construct the dam at the Green River Site with haste. This would decrease the need for all the dredging which has proven to be only a "stop gap" solution to the erosion of riverbanks and the need for levee reinforcements.

As residents of the Lexington Flood Control District, we must request the the federal government foot the bill for the land acquisition necessary for this construction, as well as for the cost of the dam proper. This flood control measure will have regional as wellaas national benefits through the protection of the Columbia River shipping lanes. The residents of the lower Cowlitz River valley already are strapped with the costs of heavy increases in flood insurance payments. In addition, the Lexington Flood control District is taxing its constituents $4.84/M to pay for the cost of rights-of-way and settlements due to the raising of our local levee.

We again implore you to assist us with the total federal funding of the Green River dam construction and land acquisition costs.

Respectfully,

Dick & Judy Ainslie

Mr. & Mrs R.A. Ainslie
105 Modesto Drive
Kelso, Washington 98626

Dec. 13-1984

Sir-

Lets get on with a 177 ft. tall debris-retaining dam on Toutle river-
Would be an answer to saving many lives - Which is more important than many ways money is being spent for-
I urge you't get on this at once.

Sincerely

Irene M. Hart

605 California way #5

Longview,
WN. 98632

12-14-'84

Col. Friedenwald,

Dear Sir.,

We are still very concerned about the silt from Mt. St. Helen's coming into the Cowlitz & Columbia Rivers which could cause a disastrous flood to all of us living near the rivers so we hope & pray that you will hurry the building of the dam on Toutle R. to prevent this from happening.

Thank you.

Yours truly,

Joe and Martha Merly
126 N. Maple
Kelso, Wa.
98626

Dec 13 1984
Kelso Wash

Colonel Robert Friedenwald.

Dear Sir:

I am so warried about the river flooding and dont know why we Can't get someaction to build the dam on the Green river, that peopel who live here in Kelso & Castel Rock, dont get flooded out.

This has been going on seince the Mt, erupted and Nothing has been done.

Peopel who dont live here dont warry or Care about us.

with the dredging that has been done Couldent there have been a dam built?

There wont be any end to the Silt & ash that Comes down the Toutel & into the Cowlitz

I s a widow and I warry about The rivers flooding and I am not the onley one.

So I Certenially hope that the dam Can be built very soon so we Can feel safe.

If you lived here wouldent you warry?

Dorothy Franck
507 Colorado #13
Kelso. Wash 98626

December 13, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208

Dear Colonel Robert Friedenwald:

This letter is in support for immediate action on the Corps preferred plan, construction of the sediment control structure at the Green River site, downstream dredging, and levee reinforcement.

We also support the requirement of no local funding for the project. Mount St. Helens is a unique disaster which occurred on federal land and therefore the financial burden should not be borne by our local community. This area has suffered through four years of dealing with the stress of the Mount St. Helens problems - the threat of flooding, loss of property, loss of business developments, high unemployment - to name just a few. This area does not need the added burden of funding this project. The federal government should fund the total project cost as it has in the past for other major natural disasters.

Thank you.

Sincerely,

Jim + Kathy Mauck

Jim & Kathy Mauck
607 Cloverdale Road
Kalama, Washington 98625

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
PO Box 2946
Portland, OR 97208

12-12-84

Dear Colonel Friedenwald:

As citizens of Cowlitz County, Washington we are very concerned & tired of the continuing sediment problem created by Mt. St. Helens. We support & encourage immediate action on the Corps of Engineers' preferred plan for the construction of the sediment control structure at the Green River site, downstream dredging & levee reinforcement.

We also support the requirement of no local funding for this project. Mount St. Helens is a unique disaster which has affected more than Cowlitz County. It is unfair to put more of the financial burden on our local community for a solution that has regional & national benefits.

We are tired of worrying about the sediment problem and would like to see a solution as soon as possible.

Thank you

Sincerely,

Nancy Boyd & Sam Boyd
106 Meadow Dr., Kelso, WA

Longview, Washington
Dec. 15, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P O Box 2946
Portland, Oregon 97208

Dear Colonel Friedenwald,

I am asking for support for immediate Corps action to construct the sediment control structure at the Green River site.

No more local funding should be required. It is unfair to put more financial burden on our local community for a solution having regional and national benefits.

Thank you for your help.

Sincerely,

Mrs. Helen Maier, Senior Citizen
271 20th
Longview, Washington 98632

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829 Fall Cr Rd
Longview Wa 98632
Dec 15 1984

Dear Sir.

I am taking a few minutes to offer my support for a sediment Retention dam on the toutle. as I believe it will save much dredging on the lower river.

I also support that this problem belies a need for federal funds as problem occurs on federal land - this area has suffered enough through high interest rates & the threat & continued plugging of our Water Ways into the future

Sincerely Yours
Frank [illegible]

Kelso, Wash
Dec. 13, 1984

Col. Robert Friedenwald,
Dist. Engr. Corps of Engrs,
PO Box 2946
Portland, Oregon, 97208....

Dear Colonel Robert:

I am a member of the Mt. St. Helens Hiking Club, PO Box 843, Longview, Wash. 98632...We have about 100 members and go on record favoring:

1...Your immediate support for Corps action to construct the sediment control structure at the Green River site;

2...That No More local funding should be required........ Mt. St. Helens was a unique disaster that occurred on federal land...It is unfair to put more financial burden on our local community for a solution having regional and national benefits...

Sincerely,

Mr/Mrs Robert & Erma Fristad
1005 No 6th Ave,
Kelso, Wash... 98626
phone 206-423-7789....

Robert K Fristad
Erma Fristad

2324 48th Ave.
Longview, Wa 98632
December 14, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P. O. Box 2946
Portland, OR 97208

Dear Sir:

As a concerned homeowner in the Longview area, part of the flood plain of the Toutle and Cowlitz Rivers, I am asking your support for the following:

1. Immediate corps action to construct the sediment control structure on the Toutle at the Green River site.

2. The Mt. St. Helens disaster was unique and that no more local funding should be required. This disaster occured on federal lands and it is unfair to put more financial burden on our local community for a solution having regional and national benefits.

Thank you for your consideration in this matter:

Sincerely;

Carl H Dunning
Carl H. Dunning

Dec. 10, 1984

Col. Robert Friedenwald
Army Corps of Engineers
P.O. BOX 2946
Portland, Ore. 97208

Dear Sir:

We are taking this means to express our views of the solution to the Mt. St. Helens problem. For 4½ years now, we have lived with the potential hazards of flooding on the Toutle and Cowlitz Rivers. National Flood Insurance rates have increased so much that many home owners have dropped the coverage.

We strongly support immediate action on the construction of the 177 foot tall debris-retaining dam on the Toutle River. Furthermore, we feel the federal government should finance the total cost of such a dam. Our local economy is poor and should not be expected to take on further burdens.

Sincerely,
Mr. + Mrs. Paul Gilpin
1135-9th Ave.
Longview, Wash 98632

December 15 1984

Colonel Robert Friedenwald
District Engineer, Corps of Engineers
P O Box 2946
Portland OR 97208

Please! We need your support for immediate Corps action to construct the sediment control structure at the Green River site. We in the Cowlitz River corridor live with the fear of flooding, if the huge sediment in the Toutle valley breaks loose.

Remember, Mount St Helens was a unique disaster that occurred on federal land and it is unfair to put such a financial burden of paying a large sum of money to help the project. We are still a depressed community on the economic scale, so would really appreciate all the help you can give us.

In advance, I and my family thank you very much.

Most Sincerely,
Mrs. Genevieve Mayo
Mrs Genevieve Mayo
1634 Minor Rd #2
Kelso WA 98626

Dec 12, 1984

Army Corp of Engineers:

We are writing to urge that the Corps begin work as soon as possible on the debris-retaining dam that has been proposed for the Toutle River. We would hope that after four years this constant threat and problem will be taken care of. If this is delayed, and a disaster happens, I'm sure the people in the St. Helen's flood plain will not be as easy to explain to as the residents of India.

I would also urge that the Army Corps would see it's way clear to pay the cost of this project, instead of laying part of the cost on the residents here who had no part in the eruption and who have already assumed considerable expense in the ongoing cleanups and protective measures.

Sincerely,

William & Esther M. King
2943 Field St.
Longview, Wa. 98632

Longview, Wash.
Dec 12, 1984.

District Engineer,

I am writing in regard to the Dam we need so badly on the Toutle River that affects a lot of towns here in Cowlitz County. Mt. St. Helens has caused so much damage to a lot of people I think the Government should do All they Can to stop any further damage as soon as possible. We need Action as fast as possible.

Sincerely,
Hairett McDaniel
365 18th St.
Longview, Wash.
98632

12-7-84

Dear Colonel Friedenwald,

I am supporting immediate action on the construction of the sediment control structure at the Green River site along with levee reinforcement and down stream dredging.

I am against local funding as I feel the problem originated on federal land and the local community has had an unfair financial burden placed upon it.

Thank you.

Sincerely
Donna R Rolfe

Dec. 12, 1984

Col. Robert Friedenwald
District Engineer
Army Corps of Engineers

Dear Col. Friedenwald

We would like to see quick construction of the 177-foot tall debris-retaining dam on the Toutle River.

Thank You for Your time.

Paula Bartlett
Bob Bartlett
1608 Holcomb Ave
Kelso, Wash. 98626

Portland District
U.S. ARMY Corps of Engineers
ATTN NPPPL-AP
P.O. BOX 3946
Portland, Oregon 97208

1530 N.E. 10th Ave.
Portland, Oregon 97232
Nov. 24, 1984

Dear colonel;

In responce to your communication relating to plans for a permadent solution to the sediment control problem on the Toutle, Cowlitz, and Columbia River

Bearing in mind the enormous problem you were faced with at the time uncontrolled sediment clogged the Columbia river to the extent that ships were unable to proceed to their destination, until the sediment was removed.

So, needless to say, your plan to create a permanent solution to eliminate that problem, especially considering that it is possible that further volcanic, unexpected activity on Mt. St Helens, could make the problem of re permanent removal of sediment more difficult

yes. I would appreciate having a copy of the material relating to to this project sent to my above address. Thank you

STANLEY G. HOOPER

Stanley G. Hooper

sent 11/27/84 jd

115 Williams Ave.
Kelso - Wa 98626
Dec. 13, 1984

Dear Sir:

For four years we've waited for some action on a permanent solution to sediment in the Toutle & Cowlitz rivers from St. Helens. There have been briefings & studies and more studies and then more studies. In the meantime we keep buying expensive flood insurance every year and pray we won't need it for our home of 33 years.

Now more local funding is being asked for. How come the local taxpayers are asked to pay for a disaster that occurred on federal land?

If the powers that be had acted sooner instead of demanding one study after another, look at the money that would have been saved on making the studies plus the dredging every year.

It's finally been decided that the one dam is the best way to go. What are we waiting for now?

A Concerned homeowner
& Taxpayer
Ferne Vining
Ralph L. Vining

~~Longview~~ Longview Wn
Dec, 16.84

Colonel Robert Friedenwald
Corps of Engineers
Portland Ore.

Dear Sir.

We all hope the construction of a Sediment structure on the Green River site will be done. As soon as possible.

With out more funding by the people in this area. With so many people out of work its really been rough for so many.

Yours Truly
Muriel L. Gulickson
2245 - 40 th
Longview Wn
98632

Dec. 14. 1984

Colonel Robert Friedenwald:

You have our support for immediate Corps action to construct the sediment control structure at the Green River site.

Also please request that no more local funding be required. Mt. St. Helen's was a unique disaster that occurred on federal land.

This has been a tremendous emotional + financial burden for our community. Let's get it resolved.

Thank You,
Doris DeGroot
David A. DeGroot

605 Peardale Lane #27
Longview, WA 98632

December 11, 1984

Colonel Robert Friedenwald
District Engineer
Corps of Engineers
P.O. Box 2946
Portland, OR 97208

RE: Mt. St. Helens Recovery Issues

Dear Colonel Friedenwald:

As a concerned citizen, I would like to offer the following comments. I believe the federal government should act in the most expeditious manner possible to alleviate the threat of continued problems from the Mt. St. Helens eruption.

The on-going damage to navigable waterways, local economic recovery and community stability can be alleviated if a long-term permanent solution is implemented quickly. It appears that the preferred plan proposed by the Corps is the best option for doing just that.

However, by requiring local and state governments to participate in funding this project, the very problems for which the project is needed will be adversely affected. Local economic recovery and community stability will not benefit by the imposition of a financial burden to the state and local governments.

A volcanic eruption is an unusual and rare disaster in this country. The necessary steps which must be taken to minimize the long-term negative impacts from this occurrence need to be seen as a one-time exceptional response. It would be appreciated if you would urge the federal government to offer assistance without further cost to the state and local governments. Thank you.

Sincerely yours,

Beverly Bright

Beverly Bright

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15 November 1984

Hey, I know this sounds like a goofball idea but, read this article about beavers, could it some how be implimented as "minor retention conservation.

Also, about the "plug" between the mountain and Harry's ridge are you going to fill that in with ~~[illegible]~~ rock to attack the erosion? and possible "wash-out"?

Thank-you

Malcolm Worrell

Malcolm Worrell
808 So. 3
Kelso, WA.
98632

206-425-2037